

## *Curriculum Vitae*

**Sidney M. Hecht**

### **Education**

- 1966 B.A., Chemistry; University of Rochester  
1970 Ph.D., Chemistry (minor: Biochemistry), University of Illinois

### **Employment**

#### *University of Wisconsin*

- 1970 National Institutes of Health Postdoctoral Fellow

#### *Massachusetts Institute of Technology*

- 1971-75 Assistant Professor of Chemistry  
1975-79 Associate Professor of Chemistry

#### *University of Virginia*

- 1978- John W. Mallet Professor of Chemistry; Professor of Biology

#### *Smith Kline & French Laboratories*

- 1981-83 Vice President, Preclinical Research & Development  
1983-86 Vice President, Chemical Research & Development  
1986-87 SK&F Distinguished Fellow

### **Awards**

- 1967-70 National Institutes of Health Predoctoral Fellow  
1970-71 National Institutes of Health Postdoctoral Fellow  
1975-79 Alfred P. Sloan Research Fellow  
1975-80 National Institutes of Health Research Career Development Awardee  
1977-78 John Simon Guggenheim Memorial Fellow  
1996 Arthur C. Cope Scholar Award  
1996 Virginia's Outstanding Scientist  
1998 Research Achievement Award, American Society of Pharmacognosy

### **Other Academic Appointments, Lectureships**

- 1978 Visiting Professor, Max-Planck Institut für experimentelle Medizin, Göttingen  
1979-81 Center for Advanced Studies, University of Virginia  
1984 T.Y. Shen Visiting Professor, Massachusetts Institute of Technology  
1985 Percy Julian Lectureship, Howard University  
1991 Professeur Associé, Muséum National D'Histoire Naturelle, Paris  
1991 Gastprofessor, Eidgenössische Technische Hochschule, Zurich  
1991 H.C. Brown Lectureship, Purdue University  
1992 Ralph Hirschmann Lectureship, Oberlin College  
1993 Webster-Sibilsky Lectureship, University of Illinois at Chicago  
1994 Distinguished Biochemistry Lectureship, University of Toledo  
1997 Eli Lilly Lectureship, Colorado State University  
1997 Nelson J. Leonard Distinguished Lectureship, University of Illinois  
1997 Servier Lectureship, Université de Montréal  
1999 Frontiers in Organic Chemistry Lectureship, Brigham Young University  
2000 W. Allan Powell Lectureship, University of Richmond/American Chemical

	Society, Virginia Section
2000	Professeur Associé, Muséum National D'Histoire Naturelle, Paris
2000	Novum Lectureship, Karolinska Institutet, Stockholm
2001	Marcel-Piché Lectureship, Institut de Recherches Cliniques de Montréal
2001	UCLA/Isis Lectureship
2002	Western Switzerland Universities Lectureship

### Professional Societies

The Chemical Society  
 American Chemical Society  
 American Society for Biochemistry and Molecular Biology  
 American Association for the Advancement of Science  
 American Society of Pharmacognosy  
 Sigma Xi

### Invited Lectures

- 1983      *Northwestern University* (Chemistry Department): Invited Lecturer  
*University of Virginia* (Biology Department): Invited Lecturer  
*University of Virginia* (Microbiology Department): Invited Lecturer  
*University of Rochester* (Chemistry Department): Invited Lecturer  
*University of Rochester* (Medical School): Invited Lecturer  
*Gordon Research Conference on Carbohydrates*: Invited Lecturer  
*National Cancer Institute Symposium on the Discovery and Development of Naturally Occurring Antitumor Agents*, Frederick, MD: Invited Lecturer  
*National Cancer Institute Workshop on Biological Modulators*, Gaithersburg, MD: Invited Lecturer  
*University of Illinois* (Chemistry Department): Invited Lecturer  
*University of Illinois* (Biochemistry Department): Invited Lecturer  
*Beckman Instruments* (Peptide Chemistry Department): Invited Lecturer  
*University of California, Los Angeles* (Chemistry Department): Invited Lecturer  
*California Institute of Technology* (Division of Chemistry and Chemical Engineering): Invited Lecturer  
*University of California, Davis* (Chemistry Department): Invited Lecturer  
*Baylor College of Medicine*: Invited Lecturer
- 1984      *Centennial Symposium, School of Pharmacy, Purdue University*: Invited Lecturer  
*University of California, San Francisco* (VA Hospital): Invited Lecturer  
*Villanova University* (Chemistry Department): Invited Lecturer  
*American Chemical Society, Joint Great Lakes/Central Regional Meeting, Kalamazoo*: Invited Lecturer  
*Gordon Research Conference on Natural Products*: Invited Lecturer  
*Annual Meeting, Plant Growth Regulator Society*, Boston: Invited Lecturer  
*25<sup>th</sup> Annual Meeting, American Society of Pharmacognosy*, Austin: Invited Lecturer  
*188<sup>th</sup> National American Chemical Society Meeting*, Philadelphia: Invited Lecturer  
*Pacific Conference on Chemistry and Spectroscopy*, Sacramento: Invited Lecturer  
*Symposium on Bioorganic Chemistry*, U. of Maryland: Invited Lecturer  
*Massachusetts Institute of Technology* (Chemistry Department): T.Y. Shen  
 Visiting Professor  
*International Chemical Congress of Pacific Basin Societies, Honolulu*: Invited Lecturer

- 1985 *University of Mississippi* (Pharmacognosy Department): Invited Lecturer  
*Gordon Research Conference on Oxygen Radicals in Medicine and Biology*: Invited Lecturer  
*Howard University* (Chemistry Department, Sigma Xi): Percy Julian Lectureship  
*University of Utah* (Medicinal Chemistry Department): Invited Lecturer  
*American Chemical Society, 15th Northwestern Regional Meeting*, SUNY New Paltz: Invited Lecturer  
*International Research Conference on Natural Products*, Chapel Hill: Plenary Lecturer  
*Gordon Research Conference on Enzymes, Coenzymes and Metabolic Pathways*: Invited Lecturer  
*Santa Fe Graduate Medicinal Chemistry Conference*: Keynote Speaker  
*American Society for Pharmacology and Experimental Therapeutics/American Chemical Society Joint Meeting*, Boston: Invited Lecturer  
*University of Washington* (Chemistry Department): Invited Lecturer
- 1986 *State University Leiden* (Chemistry Department): Invited Lecturer  
*Université Catholique de Louvain* (Chemistry Department): Invited Lecturer  
*American Chemical Society, 191st National Meeting*: Invited Lecturer  
*University of Illinois* (Chemistry Department): Invited Lecturer  
*University of Wisconsin* (Chemistry Department): American Chemical Society Lectureship  
*Harvard University* (Chemistry Department): Invited Lecturer  
*American Society of Biological Chemistry/American Chemical Society Joint Meeting*, Washington, DC: Invited Lecturer  
*Stanford University* (Chemistry Department): Invited Lecturer  
*Cornell University* (Chemistry Department): Invited Lecturer
- 1987 *Second International Conference on Anticarcinogenesis and Radiation Protection*, Gaithersburg, MD: Invited Lecturer  
*Museum National d'Histoire Naturelle*: Invited Lecturer  
*Institut de Chimie des Substances Naturelles*: Invited Lecturer  
*University of Massachusetts*, Amherst (Polymer Science and Engineering Department): Invited Lecturer  
*Hoffmann-La Roche*, Nutley: Invited Lecturer  
*American Chemical Society, 42nd Northwest Regional Meeting*, Washington: Invited Lecturer  
*Yale University* (Chemistry Department): Invited Lecturer  
*International Conference on Perspectives in Molecular Approaches to Human Diseases*, Bari: Invited Lecturer  
*Rensselaer Polytechnic Institute* (Chemistry Department): Invited Lecturer  
*Centre National de la Recherche Scientifique*, Toulouse (Laboratoire de Chimie de Coordination): Invited Lecturer  
*State University Leiden* (Chemistry Department): Invited Lecturer  
*Eidgenössische Technische Hochschule, Zurich* (Chemistry Department): Invited Lecturer  
*Eidgenössische Technische Hochschule, Zurich* (Biochemistry Department): Invited Lecturer
- 1988 *University of Nebraska* (Eppley Institute): Invited Lecturer  
*University of Missouri* (Chemistry Department): Invited Lecturer  
*American Chemical Society, Brazosport Section*: Invited Lecturer  
*University of California, Davis* (Chemistry Department): Invited Lecturer

*Johns Hopkins University* (Biophysics Division): Invited Lecturer  
*16<sup>th</sup> International IUPAC Symposium on the Chemistry of Natural Products*,  
 Kyoto: Invited Lecturer  
*IUPAC Nagoya Symposium on New Topics in Natural Products*, Toba: Plenary  
 Lecturer  
*Osaka University* (Institute for Scientific and Industrial Research): Invited  
 Lecturer  
*Kyoto University* Synthetic Chemistry Department): Invited Lecturer  
*Nagoya University* (Molecular Biology Department): Invited Lecturer  
*Showa University* (Synthetic Chemistry Department): Invited Lecturer  
*Tokyo Institute of Technology* (Chemistry Department): Invited Lecturer  
*Tokyo University* (Pharmaceutical Sciences Department): Invited Lecturer  
*Institute for Physical and Chemical Research*, Tokyo: Invited Lecturer  
*Gulf Coast Chemistry Conference*, Pensacola: Invited Lecturer  
*International Symposium on the Molecular Basis of Specificity of DNA-*  
*Antitumor Drug Interactions*, Talloires: Invited Lecturer  
*NIH Workshop on Bioassays for Discovery of Antitumor and Antiviral Agents*  
*from Natural Sources*, Bethesda: Invited Lecturer  
*Symposium on the Molecular Basis of Inorganic Pharmaceuticals*, Northwestern  
 University: Invited Lecturer

1989 *University of Miami* (Chemistry Department): Invited Lecturer  
*Johns Hopkins University* (Pharmacology Department): Invited Lecturer  
*SUNY Binghamton* (Chemistry Department): Invited Lecturer  
*University of Nebraska* (Chemistry Department): Invited Lecturer  
*Gordon Research Conference on the Chemistry of Heterocyclic Compounds*:  
 Invited Lecturer  
*Royal Society of Chemistry Meeting on Molecular Mechanisms in Bioorganic*  
*Processes*, Newcastle upon Tyne: Invited Lecturer  
*International Conference on Bioinorganic Chemistry*, Cambridge, MA: Invited  
 Lecturer  
*Virginia Commonwealth University* (Biophysics Department): Invited Lecturer  
*Louisiana State University* (Chemistry Department): Invited Lecturer  
*Georgia State University* (Chemistry Department): Invited Lecturer  
*Ethyl Corporation* (Baton Rouge): Invited Lecturer  
*Smith Kline & French Laboratories*, King of Prussia: Invited Lecturer

1990 *Lehigh University* (Chemistry Department): Invited Lecturer  
*Merck Sharp & Dohme Research Laboratories*, Rahway: Invited Lecturer  
*Muséum National d'Histoire Naturelle*: Invited Lecturer  
*Centre National de la Recherche Scientifique*, Toulouse (Laboratoire de Chimie de  
 Coordination): Invited Lecturer  
*State University Leiden* (Chemistry Department): Invited Lecturer  
*Cambridge University* (Chemistry Department): Invited Lecturer  
*Technical University of Vienna* (Chemistry Department): Invited Lecturer  
*Eidgenössische Technische Hochschule*, Zurich (Chemistry Department): Invited  
 Lecturer  
*Eidgenössische Technische Hochschule*, Zurich (Biochemistry Department):  
 Invited Lecturer  
*Université Louis Pasteur*, Strasbourg (Chemistry Department): Invited Lecturer  
*American Chemical Society, 199<sup>th</sup> National Meeting*, Boston, *Symposium on*  
*Oxygen Activation in Catalysis: Oxidations with Metalloenzymes*: Invited  
 Lecturer

- Roussel-Uclaf Table Ronde on Non-Porphyrinic Iron Oxidation Enzymes*, Paris: Invited Lecturer  
*Institute of Cancer Research*, Sutton: Invited Lecturer  
*9<sup>th</sup> International Round Table on Nucleosides, Nucleotides and their Biological Applications*, Uppsala: Plenary Lecturer  
*University of Delaware* (Chemistry Department): Invited Lecturer  
*North Carolina State University* (Biochemistry Department): Invited Lecturer  
*Glaxo-University of North Carolina Symposium on Nucleic Acids in Catalysis and Drug Design*: Invited Lecturer  
*Schering Pharmaceutical Research*, Berlin: Invited Lecturer  
*Max Planck Institut für experimentelle Medizin*, Göttingen: Invited Lecturer  
*Consiglio Nazionale delle Ricerche*, Bologna: Invited Lecturer  
*A. Menarini Industrie Farmaceutiche*, Rome: Invited Lecturer  
*Walter Reed Army Institute for Research*: Invited Lecturer  
*Colloquium on DNA Drug Targeting*, Institut Gustave Roussy, Villejuif: Invited Lecturer  
*University of Virginia* (Division of Hematology/Oncology): Invited Lecturer
- 1991 *Johns Hopkins University* (Biochemistry Department): Invited Lecturer  
*French-American Chemical Society, 2nd Meeting, Captiva Island, Florida*: Invited Lecturer  
*Vanderbilt University* (Center in Molecular Toxicology): Invited Lecturer  
*Gordon Research Conference on Metals in Biology*: Invited Lecturer  
*Muséum National D'Histoire Naturelle* (Chemistry and Biophysics Departments): Lecture Series  
*Rhône-Poulenc*, Vitry: Invited Lecturer  
*Université Joseph Fourier*, (Chemistry Department), Grenoble: Invited Lecturer  
*Centre D'Etudes Nucleaires de Grenoble (Département de Chimie Structurale)*: Invited Lecturer  
*Université de Montpellier* (Pharmaceutical Sciences Dept.): Invited Lecturer  
*Institut de Chimie des Substances Naturelle*, Gif-sur-Yvette: Invited Lecturer  
*Centre National de la Recherche Scientifique*, Toulouse (Laboratoire de Chimie de Coordination): Invited Lecturer  
*State University Leiden* (Chemistry Department): Invited Lecturer  
*Centre Biophysique D'Orleans*: Invited Lecturer  
*Purdue University* (Chemistry Department): H.C. Brown Lectureship  
*Institut de Biologie Moléculaire et Cellulaire du CNRS*, Strasbourg: Invited Lecturer  
*Eidgenössische Technische Hochschule*, Zurich (Chemistry Department): Invited Lecturer  
*Ciba-Geigy*, Basel: Invited Lecturer  
*Second Drug Discovery and Development Symposium*, Grand Traverse: Invited Lecturer  
*University of Virginia* (Biochemistry Department): Invited Lecturer  
*North Carolina State University* (Chemistry Department): Invited Lecturer  
*Conference on Biomolecular Targeting Strategies in the Prevention and Treatment of Disease*, Charlottesville: Invited Lecturer  
*American Chemical Society, 43rd Southeast Regional Meeting*, Richmond: Invited Lecturer  
*Workshop on Molecular Aspects of the Sequence-Specific Binding of Metal Compounds to Nucleic Acids*, Royal Netherlands Academy of Arts and Sciences, Haarlem: Invited Lecturer
- 1992 *Wake Forest University* (Chemistry Department): Invited Lecturer

*Oberlin College (Chemistry Department): Ralph Hirschmann Lectureship*  
*Keystone Symposium on Molecular Biology/Metal Ion Interface, Lake Tahoe:*  
 Invited Lecturer  
*Virginia Polytechnic Institute (Microbiology Department): Invited Lecturer*  
*Virginia Polytechnic Institute (Chemistry Department): Invited Lecturer*  
*American Chemical Society Symposium on Natural Products, 203rd National Meeting, San Francisco: Invited Lecturer*  
*American Chemical Society, Symposium on DNA Cleavage and Viral Inactivation, 24th Central Regional Meeting, Cincinnati: Invited Lecturer*  
*Memorial Sloan-Kettering Cancer Center: Invited Lecturer*  
*Symposium on Copper Coordination Chemistry: Bioinorganic Perspectives, Johns Hopkins University, Baltimore: Invited Lecturer*  
*Carnegie Mellon University (Chemistry Department): Invited Lecturer*  
*Johns Hopkins University (Division of Toxicological Sciences): Invited Lecturer*  
*International Conference on Structures, Conformations and Interactions of Nucleic Acids, Fogarty International Center, National Institutes of Health: Invited Lecturer*  
*Cruachem, Ltd., Glasgow: Invited Lecturer*

1993 *American University (Chemistry Department): Invited Lecturer*  
*Institut de Biologie Moléculaire et Cellulaire du CRNS, Strasbourg: Invited Lecturer*  
*National Cancer Institute (Board of Scientific Counselors): Invited Lecturer*  
*American Chemical Society Symposium on Mechanistic Bioinorganic Chemistry, 205<sup>th</sup> National Meeting, Denver: Invited Lecturer*  
*Pennsylvania State University (Chemistry Department): Invited Lecturer*  
*University of Illinois at Chicago (School of Pharmacy): Webster-Sibilsky Lecturer*  
*University of Illinois at Chicago (Department of Medicinal Chemistry and Pharmacognosy): Invited Lecturer*  
*Symposium on DNA Chemistry, Vanderbilt University, Nashville: Invited Lecturer*  
*University of Minnesota (Department of Medicinal Chemistry): Invited Lecturer*  
*University of Minnesota (Department of Chemistry): Invited Lecturer*  
*Symposium on the Interfaces Between Chemistry & Biology, Marion Merrell-Dow, Cincinnati: Invited Lecturer*  
*American Society of Pharmacognosy/Third Drug Discovery and Development Symposium, San Diego: Invited Lecturer*  
*Bristol-Myers Squibb Pharmaceutical Research Institute, Seattle: Invited Lecturer*  
*International Conference on Bioinorganic Chemistry, San Diego: Invited Lecturer*  
*Hybridon, Worcester, MA: Invited Lecturer*  
*New York University Medical Center (Department of Environmental Medicine): Invited Lecturer*

1994 *University of Utah (Departments of Chemistry and Medicinal Chemistry): Invited Lecturer*  
*Boston College (Department of Chemistry): Invited Lecturer*  
*University of Toledo (Department of Chemistry): Distinguished Biochemistry Lecturer*  
*Scripps Research Institute (Department of Chemistry): Invited Lecturer*  
*University of California, Santa Cruz (Department of Chemistry and Biochemistry): Invited Lecturer*  
*Symposium on "Topoisomerase I Inhibitors: Molecules to Medicine", 85<sup>th</sup> Annual Meeting of the American Association for Cancer Research, San Francisco: Invited Lecturer*

- Merck Sharp & Dohme Research Laboratories* (Biochemistry Department):  
Invited Lecturer  
*American Chemical Society*, North Jersey Section: Invited Lecturer  
*Seton Hall University* (Department of Chemistry): Invited Lecturer
- 1995 *Winter Conference on Bioorganic & Medicinal Chemistry, Symposium on the Reemergence of Natural Products as a Source of New Therapeutics*, Steamboat Springs, Colorado: Invited Lecturer  
*Georgia Institute of Technology* (School of Chemistry and Biochemistry): Invited Lecturer  
*16<sup>th</sup> International tRNA Workshop*, Madison, Wisconsin: Invited Lecturer  
*Nucleic Acids Symposium*, Noordwijkerhout, the Netherlands: Invited Lecturer  
*American Chemical Society Symposium on Drug Targeting of RNA*, 210<sup>th</sup> National Meeting, Chicago: Invited Lecturer  
*NATO Workshop on "DNA Cleavers and Chemotherapy of Cancer or Viral Diseases"*, Toulouse: Invited Lecturer  
*Université Louis Pasteur* (Institut de Biologie Moléculaire et Cellulaire de CNRS), Strasbourg: Invited Lecturer  
*Stanford University* (Department of Chemistry): Invited Lecturer  
*University of Missouri* (Department of Chemistry): Invited Lecturer  
*University of Missouri* (Department of Biochemistry): Invited Lecturer  
*Université Louis Pasteur* (Magistère de Chimie-Biologie), Strasbourg: Invited Lecturer  
*University of Dundee* (Department of Biochemistry): Invited Lecturer
- 1996 *Ciba-Geigy* (Central Research): Invited Lecturer  
*University of California, Riverside* (Department of Chemistry): Invited Lecturer  
*University of California, San Diego* (Department of Chemistry): Invited Lecturer  
*37<sup>th</sup> Annual Medicinal Chemistry Symposium*, University of Buffalo: Invited Lecturer  
*Monroe Wall Symposium, Harvesting Biodiversity for Therapeutic Drugs and Foods*, Xechem/Rutgers University, New Brunswick, NJ: Invited Lecturer  
*Symposium on DNA Photonucleases*, 24<sup>th</sup> American Society for Photobiology Annual Meeting, Atlanta: Invited Lecturer  
*Gordon Research Conference on Natural Products Chemistry*: Invited Lecturer  
*5<sup>th</sup> International Symposium on Progress in Natural Product Chemistry*, Royal Society of Chemistry, Nottingham: Plenary Lecturer  
*Matt Suffness Symposium*, 37<sup>th</sup> Annual Meeting of the American Society of Pharmacognosy, Santa Cruz: Invited Lecturer  
*American Chemical Society, Symposium on Mechanisms of Metal-Mediated Biopolymer Cleavage*, 212<sup>th</sup> National Meeting, Orlando: Invited Lecturer  
*American Chemical Society Awards Symposium*, 212<sup>th</sup> National Meeting, Orlando: Award Address  
*20<sup>th</sup> IUPAC Symposium on the Chemistry of Natural Products*, Chicago: Plenary Lecturer  
*Virginia Polytechnic Institute and State University* (Department of Biochemistry): Invited Lecturer
- 1997 *Workshop on Novel Biocatalysts*, Instituto Juan March de Estudios e Investigaciones, Madrid: Invited Lecturer  
*University of Sussex* (Department of Chemistry): Invited Lecturer  
*SmithKline Beecham Pharmaceuticals Research Symposium, The Many Faces of RNA*, Cambridge University: Invited Lecturer  
*Colorado State University* (Department of Chemistry): Eli Lilly Lecturer

- University of Illinois* (School of Chemical Sciences): Nelson J. Leonard  
 Distinguished Lecturer  
*Clemson University* (Department of Chemistry): Invited Lecturer  
*17th International tRNA Workshop*, Chiba, Japan: Invited Lecturer  
*22nd Seminar on Frontier Technology* on "Structural Biology of RNA-Protein  
 System", Tokyo, Japan: Invited Lecturer  
*4th Anticancer Drug Discovery and Development Symposium*, Annapolis: Invited  
 Lecturer  
*University of Virginia* (Department of Pathology): Invited Lecturer  
*20th Gulf Coast Chemistry Conference*, Pensacola: Invited Lecturer  
*University of Richmond* (Department of Chemistry): Invited Lecturer  
*Louisiana State University* (Department of Chemistry): Invited Lecturer  
*Symposium on "Drug Targeting of Topoisomerases"*, Fifth Chemical Congress of  
 North America, Cancun, Mexico: Invited Lecturer  
*Université de Montréal* (Département de Chimie): Servier Lecturer  
*McGill University* (Department of Chemistry): Invited Lecturer
- 1998
- Johns Hopkins University* (Department of Pharmacology): Invited Lecturer  
*Scripps Research Institute* (Department of Chemistry): Invited Lecturer  
*118th Annual Meeting of the Pharmaceutical Society of Japan*, Kyoto: Invited  
 Lecturer  
*Nippon Shinyaku Co., Ltd.* (Research Laboratories): Invited Lecturer  
*Institute of Physical and Chemical Research (RIKEN)*: Invited Lecturer  
*Meiji Seika Kaisha Ltd.* (Pharmaceutical Research Center): Invited Lecturer  
*University of Tokyo* (Department of Chemistry and Biotechnology): Invited  
 Lecturer  
*University of Iowa* (Division of Medicinal and Natural Products Chemistry):  
 Invited Lecturer  
*RNA '98 (Third Annual Meeting of the RNA Society)*, Symposium on RNA  
 Therapeutics, Madison: Invited Lecturer  
*39th Annual Meeting of the American Society of Pharmacognosy*, Orlando: Award  
 Address  
*University of Mississippi*, Symposium on "Topoisomerase Targeting Agents:  
 Cancer to Chemotherapy": Invited Lecturer  
*25th Symposium on Nucleic Acids Chemistry*, Kobe: Invited Lecturer  
*Okayama University* (Department of Bioscience & Biotechnology): Invited  
 Lecturer  
*EMBO Workshop on Structure and Function of Aminoacyl-tRNA Synthetases*,  
 Mittelwihr: Invited Lecturer  
*University of Tennessee* (Department of Chemistry): Invited Lecturer
- 1999
- Carnegie Mellon University* (Department of Chemistry): Invited Lecturer  
*Gordon Research Conference on Carbohydrates*: Invited Lecturer  
*University of Illinois* (Department of Chemistry): Invited Lecturer  
*AIMECS99: Asian Federation for Medicinal Chemistry International Medicinal  
 Chemistry Symposium*, Beijing: Plenary Lecturer  
*Beijing Medical College* (Division of Chemical Sciences): Invited Lecturer  
*22nd Gulf Coast Chemistry Conference*, Pensacola: Invited Lecturer  
*5th Anticancer Drug Discovery and Development Symposium*, Detroit: Invited  
 Lecturer  
*Lehigh University* (Department of Chemistry): Invited Lecturer  
*Brigham Young University* (Department of Chemistry): Invited Lecturer  
*University of Utah* (Department of Chemistry): Invited Lecturer  
*AACR-NCI-EORTC International Conference on Molecular Targets and Cancer*



*Therapeutics*, Washington, DC: Plenary Lecturer  
*Banbury Conference on Strategies for Antibacterial Therapy*, Cold Spring Harbor  
 Laboratory: Invited Lecturer

2000 *University of Richmond* (Department of Chemistry, joint with the Virginia Section of the American Chemical Society): W. Allan Powell Lecturer  
*New York Academy of Sciences Conference* on "The Camptothecins: Unfolding Their Anticancer Potential", Washington, DC: Plenary Lecturer  
*Integrated DNA Technologies* (Research Laboratories): Invited Lecturer  
*Symposium on RNA as a Drug Target*, 220<sup>th</sup> American Chemical Society National Meeting, Washington, DC: Invited Lecturer  
*Symposium on Advances in the Chemistry of Anticancer Drug Development*, British Pharmaceutical Conference, Birmingham, UK: Invited Lecturer  
*Muséum National D'Histoire Naturelle* (Departement de Biophysique): Invited Lecturer.  
*Centre National de la Recherche Scientifique*, Toulouse (Laboratoire de Chimie de Coordination): Invited Lecturer  
*Ecole Polytechnique*, Palaiseau (Groupe de Biophysique): Invited Lecturer  
*9<sup>th</sup> Symposium on the Latest Trends in Organic Synthesis*, Gainesville: Invited Lecturer  
*Karolinska Institutet*, Stockholm (Chemistry Department): Novum Lecturer in Organic Chemistry  
*Karolinska Institutet*, Stockholm (Biological Chemistry Program): Guest Lecturer as editor of course textbooks  
*Université Victor Segalen*, Bordeaux (Departement de Chimie Biologique): Invited Lecturer  
*Université Joseph Fourier*, Grenoble (Departement de Chimie): Invited Lecturer  
*Centre d'Etudes Nucleaires de Grenoble* (Departement de Chimie Structurale): Invited Lecturer  
*Muséum National D'Histoire Naturelle*: Diplome d'Etudes Approfondies Lecturer  
*Centre Oscar Lambret* (Institut de Recherches sur la Cancer): Invited Lecturer  
*Université René Descartes* (Laboratoire de Chimie et Biochimie Pharmacologiques et Toxicologiques): Invited Lecturer  
*State University Leiden* (Chemistry Department): Invited Lecturer  
*Institut de Biologie Moléculaire et Cellulaire du CNRS*, Strasbourg: Invited Lecturer  
*Collège de France* (Section de Chimie des Interactions Moléculaires): Invited Lecturer

2001 *ISIS Pharmaceuticals*: Invited Lecturer  
*California Institute of Technology* (Division of Chemistry and Chemical Engineering): Invited Lecturer  
*National Cancer Institute* (Screening Technologies Branch, Developmental Therapeutics Program): Drug Discovery and Development Seminar  
*Wake Forest University*, William Lown Symposium (School of Medicine): Invited Lecturer  
*Aclara Biosciences* (Protein Chemistry Department): Invited Lecturer  
*Institut de Recherches Cliniques de Montréal*: Marcel-Piché Lecturer  
*ICN Pharmaceuticals* (Biochemical R&D): Invited Lecturer  
*ISIS Pharmaceuticals*: UCLA/ISIS Lectureship  
*UCLA* (Department of Chemistry and Biochemistry): UCLA/ISIS Lectureship  
*Gordon Research Conference on Natural Products*: Invited Lecturer  
*2<sup>nd</sup> Oxford Symposium on "Topoisomerase Targeting Agents: Chemistry to Chemotherapy"*: Oxford, Mississippi: Invited Lecturer

*Boston College* (Department of Chemistry): Invited Lecturer  
*University of Connecticut* (Department of Chemistry): Invited Lecturer  
*Brooklyn College CUNY* (Department of Chemistry): Invited Lecturer

2002 *ISIS Pharmaceuticals*: Invited Lecturer  
**Lecture tour of western Switzerland**, including  
*Université de Genève* (Département de Chimie): Invited Lecturer  
*École Polytechnique Fédérale de Lausanne* (Département de Chimie): Invited Lecturer  
*University of Berne* (Department of Chemistry): Invited Lecturer  
*University of Basel* (Department of Chemistry): Invited Lecturer  
*University of Basel* (Department of Biochemistry): Invited Lecturer  
  
*National Cancer Institute-Frederick* (Developmental Therapeutics Program): Invited Lecturer  
*Institut de Chimie des Substances Naturelle*, Gif-sur-Yvette: Invited Lecturer  
*Southeastern Regional American Chemical Society Meeting*, Nucleic Acids Symposium, Charleston, Invited Lecturer  
*14th EORTC-NCI-AACR Symposium on Molecular Targets and Cancer Therapeutics*, Frankfurt: Invited Lecturer

## Editorial

1986- Editorial Advisory Board, *Anti-Cancer Drug Design*  
1987-90 Editorial Advisory Board, *Chemical Research in Toxicology*  
1989-95 Invited Expert Analyst, *Chemtracts-Organic Chemistry*  
1990-91 Associate Editor, *Medicinal Chemistry Research*  
1991-98 Editorial Advisory Board, *Journal of Molecular Recognition*  
1992- Editorial Advisory Board, *Bioconjugate Chemistry*  
1992- Associate Editor, *Journal of the American Chemical Society*  
1993-98 Bioorganic Chemistry Series Editor, Oxford University Press  
1996-97 Guest Editor, Symposium-in-Print on "Strategies for RNA Recognition", *Bioorganic & Medicinal Chemistry*  
1997-99 Editorial Advisory Board, *Molecules Online*  
2000- Editorial Advisory Board, *Current Medicinal Chemistry-Anticancer Agents*

## Committees/National Service

1978 Co-organizer (with H. Umezawa), East-West Conference on Bleomycin  
1979 Organizer, Symposium on Antitumor Agents, ACS National Meeting - Houston  
1981-83 Member, Bioorganic and Natural Products Study Section, National Institutes of Health  
1984 Organizer, Symposium, ACS Regional Meeting - Raleigh/Durham  
1985-89 Member, Walter Reed Scientific Advisory Board  
1986 Ad hoc member, Chemical Pathology Study Section, National Institutes of Health  
1986-90 Member, California Institute of Technology Chemistry and Chemical Engineering Division Visiting Committee  
1987-91 Member, Advisory Board, Research Institute of Pharmaceutical Sciences, University of Mississippi  
1988 Ad hoc member, Bioorganic and Natural Products Study Section, National Institutes of Health  
1988 Ad hoc member, Metallobiochemistry Study Section, National Institutes of Health

- 1988-92 Chairman, Chemical Technologies Advisory Board, SmithKline Beecham Pharmaceuticals
- 1989-94 Member, Board of Directors, Harbor Branch Oceanographic Institution
- 1989 Member, Ad Hoc Advisory Committee, Antitumor and Anti-HIV Drug Discovery Screening Program, Division of Cancer Treatment, National Cancer Institute
- 1990-00 Member, R&D Advisory Board, SmithKline Beecham Pharmaceuticals
- 1990 Organizer, Symposium on BioOrganic Chemistry, University of Virginia Chemistry Department
- 1991 Co-organizer (with C. Evans) Conference on Biomolecular Recognition and Targeting Strategies in the Prevention and Treatment of Disease, Charlottesville
- 1991-92 American Chemical Society Committee for the preparation of "Science & Serendipity. The Importance of Basic Research"
- 1992 Member, Review Panel for National Cooperative Drug Discovery Group Applications, National Cancer Institute
- 1992-93 Chairman, Review Panel for Laboratory of Medicinal Chemistry, National Cancer Institute
- 1992-97 Member, Scientific Advisory Board, Cruachem, Ltd.
- 1993-95 Member, Board of Scientific Counselors, Division of Cancer Treatment, National Cancer Institute
- 1993-97 Member, Scientific Advisory Board, Magainin Pharmaceuticals
- 1993-97 Chairman, Discovery Advisory Board, SmithKline Beecham Pharmaceuticals
- 1994 Member, Review Panel for Laboratory of Molecular Pharmacology, National Cancer Institute
- 1994 Chairman, Department of the Army Molecular Biology Review Panel for Breast Cancer Proposals
- 1995 Chairman, Review Panel for Laboratory of Drug Discovery Research & Development, National Cancer Institute
- 1995- Member, Board of Directors, Orchid BioSciences
- 1997- Chairman, Scientific Advisory Board, Orchid BioSciences
- 1998-99 Member, Corporate Technology Board, SmithKline Beecham Pharmaceuticals
- 1998-01 Member, Board of Directors, Annovis, Inc.
- 1999 Chairman, Special Emphasis Review Panel, National Cancer Institute
- 2000- Member, Board of Directors, Pinnacle Pharmaceuticals
- 2000- Member, Scientific Advisory Board, PALUMED
- 2002- Chairman, Scientific Advisory Board, Galileo Laboratories

### **Consulting**

- 1979-81 Merck Sharp & Dohme Research Laboratories
- 1987-00 SmithKline Beecham Pharmaceuticals
- 1989-94 Harbor Branch Oceanographic Institution
- 1992-97 Cruachem, Ltd.
- 1993-97 Magainin Pharmaceuticals
- 1997-99 Orchid BioSciences
- 1997-01 Annovis, Inc.
- 2000- Xenogen, Inc.
- 2000- Pinnacle Pharmaceuticals, Inc.
- 2000- PALUMED
- 2001- Isis Pharmaceuticals
- 2001- Galileo Laboratories

### **Research Interests**

- Synthesis and mechanism of action of bleomycin family antitumor antibiotics
- Peptidyltransferase as a source of synthetic enzymes
- Mechanism of action/inhibition of mammalian DNA topoisomerase I
- Identification of natural products having potential as antitumor agents via mechanistically focused screens

### **Research Support**

- NIH National Cooperative Natural Products Drug Discovery Grant CA50771, Mechanism-Based Discovery of Novel Antitumor Agents
- NIH Research Grant CA76297, Interaction of Bleomycin with RNA and DNA
- NIH Research Grant CA77284, Synthesis of Bleomycin Group Antibiotics and Analogues
- NIH Research Grant CA77359, Elaboration of Modified Proteins Using Misacylated tRNAs
- NIH Research Grant CA78415, Mechanism and Inhibition of Human DNA Topoisomerase I

### **Research Coworkers Supervised**

Ph.D., M.S. Students	49
Postdoctoral Associates, Visiting Scientists	119

## Sidney M. Hecht

### Research Publications

- (1) D. P. Brust, D. S. Tarbell and S. M. Hecht, Studies of Cyclizations of an O-( $\alpha$ -Methylallyl)phenol and the Corresponding Methyl Ether Induced by Electrophilic Reagents, Proc. Natl. Acad. Sci. USA, **53**, 233-236 (1965).
- (2) D. P. Brust, D. S. Tarbell, S. M. Hecht, E. C. Hayward and L. D. Colebrook, Preparation of *cis*- and *trans*-2,3-Dimethyl-2,3-dihydrobenzofurans and Related Compounds. Cyclization Involving Oxonium Ions, J. Org. Chem., **31**, 2192-2201 (1966).
- (3) N. J. Leonard and S. M. Hecht, 6-(3-Methylbut-3-enylamino)purine: A Highly Active Cytokinin, J. C. S. Chem. Commun., 973 (1967).
- (4) S. M. Hecht, J. P. Helgeson and T. Fujii, N-(3-Methyl-2-butenyl)adenine, "Synthetic Procedures in Nucleic Acid Chemistry", John Wiley-Interscience Publishers, New York, 1968, p. 8-10.
- (5) N. J. Leonard, S. M. Hecht, F. Skoog and R. Y. Schmitz, Cytokinins: Synthesis of 6-(3-Methyl-3-butenylamino)-9- $\beta$ -D-ribofuranosylpurine (3iPA), and the Effect of Side-Chain Unsaturation on the Biological Activity of Isopentylaminopurines and their Ribosides, Proc. Natl. Acad. Sci. USA, **59**, 15-21 (1968).
- (6) W. J. Burrows, D. J. Armstrong, F. Skoog, S. M. Hecht, J. T. A. Boyle, N. J. Leonard and J. Occolowitz, Cytokinin from Soluble RNA of *Escherichia coli*: 6-(3-Methyl-2-butenylamino)-2-methylthio-9- $\beta$ -D-ribofuranosylpurine, Science, **161**, 691-693 (1968).
- (7) N. J. Leonard, S. M. Hecht, F. Skoog and R. Y. Schmitz, Cytokinins: Synthesis and Biological Activity of Related Derivatives of 2iP, 3iP, and their Ribosides, Israel J. Chem., **6**, 539-550 (1968).
- (8) N. J. Leonard, S. M. Hecht, F. Skoog and R. Y. Schmitz, Cytokinins: Synthesis, Mass Spectra and Biological Activity of Compounds Related to Zeatin, Proc. Natl. Acad. Sci. USA, **63**, 175-182 (1969).
- (9) S. M. Hecht, A. S. Gupta and N. J. Leonard, Mass Spectra of Nucleoside Components of tRNA, Anal. Biochem., **30**, 249-270 (1969).
- (10) S. M. Hecht, A. S. Gupta and N. J. Leonard, Position of Uridine Thiation: The Identification of Minor Nucleosides from Transfer RNA by Mass Spectrometry, Biochem. Biophys. Acta, **182**, 444-448 (1969).
- (11) W. J. Burrows, D. J. Armstrong, F. Skoog, S. M. Hecht, J. T. A. Boyle, N. J. Leonard and J. Occolowitz, The Isolation and Identification of Two Cytokinins from *Escherichia coli* Transfer Ribonucleic Acids, Biochemistry, **8**, 3071-3076 (1969).
- (12) S. M. Hecht, N. J. Leonard, J. Occolowitz, W. J. Burrows, D. J. Armstrong, F. Skoog, R. M. Bock, I. Gillam and B. M. Tener, Cytokinins: Isolation and Identification of 6-(3-Methyl-2-butenylamino)-9- $\beta$ -D-ribofuranosylpurine (2iPA) from Yeast Cysteine tRNA, Biochem. Biophys. Res. Commun., **35**, 205-209 (1969).

- (13) S. M. Hecht, N. J. Leonard, W. J. Burrows, D. J. Armstrong, F. Skoog and J. Occolowitz, Cytokinin from the Transfer RNA of Wheat Germ: 6-(4-Hydroxy-3-methyl-2-butenylthio)-9- $\beta$ -D-ribofuranosylpurine, Science, **166**, 1272-1274 (1969).
- (14) S. M. Hecht, N. J. Leonard, R. Y. Schmitz and F. Skoog, Cytokinins: Synthesis and Growth-Promoting Activity of 2-Substituted Compounds in the N<sup>6</sup>-Isopentenyladenine and Zeatin Series, Phytochemistry, **9**, 1173-1180 (1970).
- (15) D. J. Armstrong, P. K. Evans, W. J. Burrows, F. Skoog, J. F. Petit, J. Dahl, T. Steward, J. L. Strominger, N. J. Leonard, S. M. Hecht and J. Occolowitz, Cytokinins: Activity and Identification in *Staphylococcus epidermidis* Transfer RNA, J. Biol. Chem., **245**, 2922-2926 (1970).
- (16) S. M. Hecht, N. J. Leonard, R. Y. Schmitz and F. Skoog, Cytokinins: Influence of Side Chain Planarity of N<sup>6</sup>-Substituted Adenines and Adenosines on Cell Division and Growth, Phytochemistry, **9**, 1907-1913 (1970).
- (17) W. J. Burrows, D. J. Armstrong, M. Kaminek, F. Skoog, R. M. Bock, S. M. Hecht, L. G. Dammann, N. J. Leonard and J. Occolowitz, The Isolation and Identification of Cytokinins from the Transfer Ribonucleic Acids of Wheat Germ, Biochemistry, **9**, 1867-1872 (1970).
- (18) S. M. Hecht, Mass Spectrometric Identification of Some Prenylaminopurines, Biochim. Biophys. Acta, **213**, 269-272 (1970).
- (19) S. M. Hecht, R. M. Bock, N. J. Leonard, R. Y. Schmitz and F. Skoog, Cytokinin Activity in tRNA<sup>Phe</sup>, Biochem. Biophys. Res. Commun., **41**, 435-440 (1970).
- (20) S. M. Hecht, A. S. Gupta and N. J. Leonard, Mass Spectra of Ribonucleoside Components of tRNA. II., Anal. Biochem., **38**, 230-251 (1970).
- (21) R. Y. Schmitz, F. Skoog, S. M. Hecht and N. J. Leonard, Cytokinins: Synthesis and Biological Activity of Zeatin Esters and Related Compounds, Phytochemistry, **10**, 275-280 (1971).
- (22) S. M. Hecht, L. H. Kirkegaard and R. M. Bock, Chemical Modifications of tRNA Species. Desulfurization with Raney Nickel, Proc. Natl. Acad. Sci. USA, **68**, 48-51 (1971).
- (23) M. Sundaralingam., C. D. Stout and S. M. Hecht, The Structure of Bis(4-aminoimidazole-5-carboxamidoxime)copper(II) perchlorate, a Degradation Product of Adenine N<sup>1</sup>-oxide, J.C. S. Chem. Commun., 240-241 (1971).
- (24) S. M. Hecht, R. M. Bock, R. Y. Schmitz, F. Skoog, N. J. Leonard and J. Occolowitz, Question of the Function of the Ribosyl Moiety in the Promotion of Callus Growth by Exogenously Added Cytokinins, Biochemistry, **10**, 4224-4228 (1971).
- (25) S. M. Hecht, The Mass Spectra of Some Heterocycles Related to N<sup>6</sup>-( $\Delta^2$ -Isopentenyl)adenosine, Anal. Biochem., **44**, 262-275 (1971).
- (26) S. M. Hecht and R. M. Bock, Chemical Modifications of Transfer RNA Species. Metal Ion Binding to Monoperphthalate-Treated tRNA, Biochem. Biophys. Res. Commun., **45**, 416-420 (1971).

- (27) S. M. Hecht and R. M. Bock, R. Y. Schmitz, F. Skoog and N. J. Leonard, Cytokinins: Development of a Potent Antagonist, Proc. Natl. Acad. Sci. USA, **68**, 2608-2610 (1971).
- (28) S. M. Hecht and J. J. McDonald, The Mass Spectra of Some N<sup>6</sup>-acyladenines and 6-Substituted Ureidopurines, Anal. Biochem., **47**, 157-173 (1972).
- (29) R. Y. Schmitz, F. Skoog, S. M. Hecht, R. M. Bock and N. J. Leonard, Comparison of Cytokinin Activities of Naturally Occurring Ribonucleosides and Corresponding Bases, Phytochemistry, **11**, 1603-1610 (1972).
- (30) S. M. Hecht and J. W. Kozarich, A Convenient Method for the Production of Diazomethane-d<sub>2</sub>, Tetrahedron Lett., 1501-1502 (1972).
- (31) R. Y. Schmitz, F. Skoog, S. M. Hecht and N. J. Leonard, Comparison of Zeatin Indoleacetate with Zeatin and Indoleacetic Acid in the Tobacco Bioassay, Plant Physiol., **50**, 114-116 (1972).
- (32) S. M. Hecht and M. Sundaralingam, Stereochemistry of Nucleic Acids and Their Constituents. XXVII. The Crystal and Molecular Structure of a 1:1 Adduct of Ethanol and 3'-Deoxy-3'-(dihydroxyphosphinylmethyl)adenosine, an Analog of 3'-AMP, J. Am. Chem. Soc., **94**, 4314-4319 (1972).
- (33) F. J. Schmidt, R. M. Bock and S. M. Hecht, Chemical Modifications of Transfer RNA Species. Heavy Atom Derivatization of Aminoacyl tRNA, Biochem. Biophys. Res. Commun., **48**, 451-456 (1972).
- (34) R. C. Gallo, S. M. Hecht, J. Whang-Peng and S. O'Hopp, N<sup>6</sup>-( $\Delta^2$ -isopentenyl)adenosine. The Regulatory Effect of a Cytokinin and Modified Nucleoside from tRNA on Human Lymphocytes, Biochem. Biophys. Acta, **28**, 488-500 (1972).
- (35) S. M. Hecht and J. W. Kozarich, The Base-Induced Decomposition of N-Nitroso-N-methylurea, Tetrahedron Lett., 5147-5150 (1972).
- (36) F. Skoog, R. Y. Schmitz, R. M. Bock and S. M. Hecht, Cytokinin Antagonists: Synthesis and Physiological Effects of 7-Substituted-3-methylpyrazolo[4,3-d]-pyrimidines, Phytochemistry, **12**, 25-37 (1973).
- (37) S. M. Hecht and J. W. Kozarich, Diazomethane: Its *in situ* Generation and Utilization in Selective Methylations, Tetrahedron Lett., 1397-1400 (1973).
- (38) S. M. Hecht and J. W. Kozarich, Mechanism of the Base-Induced Decomposition of N-nitroso-N-methylurea, J. Org. Chem., **38**, 1821-1824 (1973).
- (39) S. M. Hecht and J. W. Kozarich, Demethylation of 7-Methylguanosine with Lithium 2-Methylpropane-2-thiolate, J. C. S. Chem. Commun., 387-388 (1973).
- (40) S. M. Hecht, S. D. Hawrelak, J. W. Kozarich, F. J. Schmidt and R. M. Bock, Chemical Modifications of Transfer RNA Species. Synthesis of tRNA's Terminating in 2'- and 3'-O-Methyladenosine, Biochem. Biophys. Res. Commun., **52**, 1341-1347 (1973).
- (41) S. M. Hecht and D. Werner, A Concise Synthesis of Substituted Pyrazolo[3,4-d]pyrimidines, J.C.S. Perkin Trans. 1, 1903-1906 (1973).

- (42) J. W. Kozarich, A. C. Chinault and S. M. Hecht, Ribonucleoside Phosphates via Phosphorimidazolidate Intermediates. The Synthesis of Pseudo-ATP, Biochemistry, **12**, 4458-4463 (1973).
- (43) S. M. Hecht and J. W. Kozarich, A Chemical Synthesis of  $\gamma$ -<sup>32</sup>P-Adenosine 5'-triphosphate, Biochem. Biophys. Acta, **331**, 307-309 (1973).
- (44) J. P. Helgeson, G. T. Haberlach and S. M. Hecht, On the Inhibition of Tobacco Callus and Suspension Culture by Pyrazolo[4,3-d]pyrimidine Analogs of Cytokinins, Proc. 8th Intern. Conf. on Plant Growth Subst., Tokyo, 1973, pp. 485-493.
- (45) S. M. Hecht, J. W. Kozarich and F. J. Schmidt, Isomeric Phenylalanyl-tRNA's. Position of the Aminoacyl Moiety During Protein Biosynthesis, Proc. Natl. Acad. Sci. USA, **71**, 4317-4321 (1974).
- (46) S. M. Hecht, R. D. Faulkner and S. D. Hawrelak, Competitive Inhibition of Beef Heart Cyclic AMP Phosphodiesterase by Cytokinins and Related Compounds, Proc. Natl. Acad. Sci. USA, **71**, 4670-4674 (1974).
- (47) S. M. Hecht and S. D. Hawrelak, Interaction of Glycyl-L-phenylalanine with *E. coli* Phenylalanyl-tRNA Synthetase, Biochemistry, **13**, 4967-4975 (1974).
- (48) S. M. Hecht and S. D. Hawrelak, Hydrolysis of Ribonucleoside 3'-Diphosphates by Rye Grass 3'-Nucleotidase, Biochemistry, **14**, 974-981 (1975).
- (49) J. W. Kozarich, A. C. Chinault and S. M. Hecht, Ribonucleoside 3'-Di and Triphosphates. Synthesis of Guanosine Tetraphosphate (ppGpp), Biochemistry, **14**, 981-988 (1975).
- (50) S. M. Hecht, D. Werner, D. D. Traficante, M. Sundaralingam, P. Prusiner, T. Ito and T. Sakurai. Structure Determination of the N-Methyl Isomers of 5-Amino-3,4-Dicyanopyrazole and Certain Related Pyrazolo[3,4-d]pyrimidines, J. Org. Chem., **40**, 1815-1822 (1975).
- (51) S. M. Hecht, R. B. Frye, D. Werner, S. D. Hawrelak, F. Skoog and R. Y. Schmitz, On the "Activation" of Cytokinins, J. Biol. Chem., **250**, 7343-7351 (1975).
- (52) F. Skoog, R. Y. Schmitz, S. M. Hecht and R. B. Frye, Anticytokinin Activity of Substituted Pyrrolo[2,3-d]pyrimidines, Proc. Natl. Acad. Sci. USA, **72**, 3508-3512 (1975).
- (53) S. M. Hecht and A. C. Chinault, Position of Aminoacylation of Individual *E. coli* and Yeast tRNA's, Proc. Natl. Acad. Sci. USA, **73**, 405-409 (1976).
- (54) S. M. Hecht, R. B. Frye, D. Werner, T. Fukui and S. D. Hawrelak, Synthesis and Biological Activity of Pyrazolo[3,4-d]pyrimidine Nucleosides and Nucleotides Related to Tubercidin, Toyocamycin and Sangivamycin, Biochemistry, **15**, 1005-1015 (1976).
- (55) S. M. Hecht, B. L. Adams and J. W. Kozarich, Chemical Transformations of 7,9-Disubstituted Purines and Related Heterocycles. Selective Reduction of Imines and Immonium Salts, J. Org. Chem., **41**, 2303-2311 (1976).
- (56) S. M. Hecht, K. H. Tan, A. C. Chinault and P. Arcari, Isomeric Aminoacyl-tRNA's are Both Bound by Elongation Factor Tu, Proc. Natl. Acad. Sci. USA, **74**, 437-441 (1977).



- (57) A. C. Chinault, J. W. Kozarich, S. M. Hecht, F. J. Schmidt and R. M. Bock, Preparation of *E. coli* tRNA's Terminating in Modified Nucleosides Using CTP(ATP): tRNA Nucleotidyltransferase and Polynucleotide Phosphorylase, Biochemistry, **16**, 756-765 (1977).
- (58) A. C. Chinault, K. H. Tan, S. M. Hassur and S. M. Hecht, Initial Position of Aminoacylation of Individual *Escherichia coli*, Yeast and Calf Liver Transfer RNA's, Biochemistry, **16**, 766-776 (1977).
- (59) S. M. Hecht, Participation of Isomeric tRNA's in the Partial Reactions of Protein Biosynthesis, Tetrahedron, **33**, 1671-1696 (1977).
- (60) S. M. Hecht, Utilization of Isomeric Aminoacyl-tRNA's in Peptide Bond Formation, Accts. Chem. Res., **10**, 239-245 (1977).
- (61) S. M. Hecht, P. Arcari and B. L. Adams, Isoenergetic Hydride Transfer. A Phase-Transition Mediated, Reversible tRNA Modification, J. Am. Chem. Soc., **99**, 3890-3892 (1977).
- (62) D. A. McGowan, U. Jordis, D. K. Minster and S. M. Hecht, A Biomimetic Synthesis of the Bithiazole Moiety of Bleomycin, J. Am. Chem. Soc., **99**, 8078-8079 (1977).
- (63) S. M. Hecht, Cytokinin Antagonists: Regulation of the Growth of Plant and Animal Cells, in "BioOrganic Chemistry", Vol. IV, E. E. van Tamelen, Ed., Academic Press, New York, 1978, p. 179-206.
- (64) B. L. Adams, M. Morgan, S. Muthukrishnan, S. M. Hecht and A. J. Shatkin, The Effect of "Cap" Analogs on Reovirus mRNA Binding to Wheat Germ Ribosomes. Evidence for Enhancement of Ribosomal Binding via a Preferred Cap Conformation, J. Biol. Chem., **253**, 2589-2595 (1978).
- (65) D. K. Minster, U. Jordis, D. L. Evans and S. M. Hecht, Thiazoles from Cysteinyl Peptides, J. Org. Chem., **43**, 1624-1626 (1978).
- (66) S. M. Hecht, B. L. Alford, Y. Kuroda and S. Kitano, "Chemical Aminoacylation" of tRNA's, J. Biol. Chem., **253**, 4517-4520 (1978).
- (67) B. Alford and S. M. Hecht, 2' versus 3'-OH Specificity in tRNA Aminoacylation. Further Support for the "Secondary Cognition" Proposal, J. Biol. Chem., **253**, 4844-4850 (1978).
- (68) D. K. Minster and S. M. Hecht, Synthesis of L-Gulose from D-Glucose via Aldose Interchange, J. Org. Chem., **43**, 3987-3988 (1978).
- (69) P. Arcari and S. M. Hecht, Isoenergetic Hydride Transfer. A Reversible tRNA Modification with Concomitant Alteration of Biochemical Properties, J. Biol. Chem., **253**, 8278-8284 (1978).
- (70) B. Alford, A. C. Chinault, S. O. Jolly and S. M. Hecht, Preparation of tRNA's Terminating in 2' and 3'-Deoxyadenosine, Methods Enzymol., **59G**, 121-134 (1979).
- (71) S. M. Hecht, 2'-Versus 3'-OH Specificity in tRNA Aminoacylation, in "Transfer RNA: Structure, Properties and Recognition", J. Abelson, P. Schimmel and D. Soll, Eds., Cold Spring Harbor Laboratory, N. Y., 1979, p. 345-360.

- (72) D. L. Evans, D. K. Minster, U. Jordis, S. M. Hecht, A. L. Mazzu and A. I. Meyers, Nickel Peroxide Dehydrogenation of O, S and N-Containing Heterocycles, J. Org. Chem., **44**, 497-501 (1979).
- (73) S. M. Hecht, Symposium Summary, in "Bleomycin: Chemical, Biochemical and Biological Aspects", S. M. Hecht, Ed., Springer-Verlag, New York, 1979, pp. 1-23.
- (74) S. M. Hecht, D. Burlett, Y. Mushika, Y. Kuroda and M. D. Levin, Studies on the Total Synthesis of Bleomycin, in "Bleomycin: Chemical, Biochemical and Biological Aspects", S. M. Hecht, Ed., Springer-Verlag, New York, 1979, pp. 48-62.
- (75) S. M. Hecht, K. M. Rupprecht and P. M. Jacobs, Synthesis of L-erythro- $\beta$ -Hydroxyhistidine from D-Glucosamine, J. Am. Chem. Soc., **101**, 3982-3983 (1979).
- (76) B. L. Alford, J. M. Pezzuto, K. H. Tan and S. M. Hecht, Both Positional Isomers of Aminoacyl-tRNA's are Bound by Elongation Factor Tu, J. Biol. Chem., **254**, 6894-6903 (1979).
- (77) N. J. Oppenheimer, L. O. Rodriguez and S. M. Hecht, Proton Nuclear Magnetic Resonance Study of the Structure of Bleomycin and the Zinc-Bleomycin Complex, Biochemistry, **18**, 3439-3445 (1979).
- (78) B. L. Alford and S. M. Hecht, Transfer RNA Control of the Activation of Isomeric tRNA<sup>T<sub>rp</sub></sup>s, J. Biol. Chem., **254**, 6873-6875 (1979).
- (79) N. Sonenberg, K. M. Rupprecht., S. M. Hecht and A. J. Shatkin, Eukaryotic mRNA Cap Binding Protein: Purification by Affinity Chromatography on Sepharose-Coupled m<sup>7</sup>GDP, Proc. Natl. Acad. Sci. USA, **76**, 4345-4349 (1979).
- (80) S. M. Hecht, Anticytokinins as Probes of Cytokinin Utilization, in "Plant Growth Substances", N. B. Mandava, Ed., ACS Symposium Series 111, Washington, 1979, pp. 79-98.
- (81) N. J. Oppenheimer, L. O. Rodriguez and S. M. Hecht, Structural Studies of "Active Complex" of Bleomycin: An Assignment of the Ligands to the Ferrous Ion in a Ferrous-Bleomycin-Carbon Monoxide Complex, Proc. Natl. Acad. Sci. USA, **76**, 5616-5620 (1979).
- (82) M. D. Levin, K. Subrahmanian, H. Katz, M. B. Smith, D. J. Burlett and S. M. Hecht, Bleomycin: Synthesis and Structural Verification of the Tripeptide S and Tetrapeptide S Moieties, J. Am. Chem. Soc., **102**, 1452-1453 (1980).
- (83) J. M. Pezzuto and S. M. Hecht, Amino Acid Substitutions in Protein Biosynthesis. Poly A-Directed Polyphenylalanine Synthesis, J. Biol. Chem., **255**, 865-869 (1980).
- (84) S. M. Hecht, Nucleoside Phosphates as Probes of the Mechanism of Protein Biosynthesis, in "Phosphorous Chemistry Directed Towards Biology", W. J. Stec, Ed., Pergamon Press, Oxford, 1980, pp. 219-231.
- (85) J. M. Pezzuto, P. P. Lau, Y. Luh, P. D. Moore, G. N. Wogan and S. M. Hecht, There is a Correlation Between the DNA Affinity and Mutagenicity of Several 3-Amino-1-methyl-5H-pyrido[4,3-b]indoles, Proc. Natl. Acad. Sci. USA, **77**, 1427-1431 (1980).

- (86) N. Sonenberg, H. Trachsel, S. Hecht and A. J. Shatkin, Differential Stimulation of Capped mRNA Translation *in vitro* by Cap Binding Protein, Nature, **285**, 331-333 (1980).
- (87) N. J. Oppenheimer, L. O. Rodriguez and S. M. Hecht, Metal Binding to Modified Bleomycins. Zinc and Ferrous Complexes with an Acetylated Bleomycin, Biochemistry, **19**, 4096-4103 (1980).
- (88) H. Arai, W. K. Hagmann, H. Suguna and S. M. Hecht, Synthesis of the Pyrimidine Moieties of Bleomycin and Epibleomycin, J. Am. Chem. Soc., **102**, 6631-6633 (1980).
- (89) A. Dell, H. R. Morris, S. M. Hecht and M. D. Levin, Characterization of Guanidino-Containing Antibiotics: Field Desorption Mass Spectrometry of Bleomycin B<sub>2</sub> and Phleomycins D<sub>1</sub> and E, Biochem. Biophys. Res. Commun., **97**, 987-994 (1980).
- (90) S. M. Hecht, Probing the Cytokinin Receptor Sites, in "Plant Growth Substances 1979", F. Skoog, Ed., Springer-Verlag, Berlin, 1980, pp. 144-158.
- (91) J. M. Pezzuto, P. D. Moore and S. M. Hecht, Metabolic Activation of 1-Methyl-3-amino-5H-pyrido[4,3-b]indole and Several Structurally Related Mutagens, Biochemistry, **20**, 298-305 (1981).
- (92) N. J. Oppenheimer, C. Chang, L. O. Rodriguez and S. M. Hecht, Copper(I)-Bleomycin. A Structurally Unique Redox-active Complex, J. Biol. Chem., **256**, 1514-1517 (1981).
- (93) T. Ohgi and S. M. Hecht, (2S,3S,4R)-4-Amino-3-hydroxy-2-methylvalerate: Synthesis of an Amino Acid Constituent of Bleomycin from L-Rhamnose, J. Org. Chem., **46**, 1232-1234 (1981).
- (94) W. K. Hagmann, F. Z. Basha, M. Hashimoto, R. B. Frye, S. Kojo and S. M. Hecht, Chemistry of 2-Substituted Pyrimidines. Studies Directed toward the Synthesis of the Pyrimidine Moiety of Bleomycin, J. Org. Chem., **46**, 1413-1423 (1981).
- (95) K. M. Rupprecht, N. Sonenberg, A. J. Shatkin and S. M. Hecht, Design and Preparation of Affinity Resins for the Purification of Eukaryotic mRNA Cap Binding Protein, Biochemistry, **20**, 6570-6577 (1981).
- (96) V. Pozsgay, T. Ohgi and S. M. Hecht, Synthesis of the Carbohydrate Moiety of Bleomycin, J. Org. Chem., **46**, 3761-3763 (1981).
- (97) A. Dell, H. R. Morris, M. D. Levin and S. M. Hecht, Field Desorption and Fast Atom Bombardment Mass Spectrometry of Bleomycins and Their Derivatives, Biochem. Biophys. Res. Commun., **102**, 730-738 (1981).
- (98) K. Nishikawa, B. L. Adams and S. M. Hecht, Chemical Excision of Apurinic Acids from RNA. A Structurally Modified Yeast tRNA<sup>Phe</sup>, J. Am. Chem. Soc., **104**, 326-328 (1982).
- (99) L. O. Rodriguez and S. M. Hecht, Iron(II)-Bleomycin. Biochemical and Spectral Properties in the Presence of Radical Scavengers, Biochem. Biophys. Res. Commun., **104**, 1470-1476 (1982).
- (100) N. J. Oppenheimer, C. Chang, L.-H. Chang, G. Ehrenfeld, L. O. Rodriguez and S. M. Hecht, Deglyco-bleomycin. Degradation of DNA and Formation of a Structurally Unique Fe(II)-CO Complex, J. Biol. Chem., **257**, 1606-1609 (1982).

- (101) J. Kross, W. D. Henner, W. A. Haseltine, L. Rodriguez, M. D. Levin and S. M. Hecht, Structural Basis for the DNA Affinity of Bleomycins, Biochemistry, **21**, 3711-3721 (1982).
- (102) J. Kross, W. D. Henner, S. M. Hecht and W. A. Haseltine, Specificity of Deoxyribonucleic Acid Cleavage by Bleomycin, Phleomycin and Tallysomylin, Biochemistry, **21**, 4310-4318 (1982).
- (103) N. Murugesan, G. M. Ehrenfeld and S. M. Hecht, Oxygen Transfer from Bleomycin-Metal Complexes, J. Biol. Chem., **257**, 8600-8603 (1982).
- (104) Y. Aoyagi, H. Suguna, N. Murugesan, G. M. Ehrenfeld, L.-H. Chang, T. Ohgi, M. S. Shekhani, M. P. Kirkup and S. M. Hecht, Deglycobleomycin: Total Synthesis and Oxygen Transfer Properties of an Active Bleomycin Analog, J. Am. Chem. Soc., **104**, 5237-5239 (1982).
- (105) Y. Aoyagi, K. Katano, H. Suguna, J. Primeau, L.-H. Chang and S. M. Hecht, Total Synthesis of Bleomycin, J. Am. Chem. Soc., **104**, 5537-5538 (1982).
- (106) K. Nishikawa and S. M. Hecht, A Structurally Modified Yeast tRNA<sup>Phe</sup> with Six Nucleotides in the Anticodon Loop Lacks Significant Phenylalanine Acceptance, J. Biol. Chem., **257**, 10536-10539 (1982).
- (107) J. R. Pellon, A. J. Sinskey, S. M. Hecht and R. F. Gomez, Kinetics of the Bleomycin A<sub>2</sub> Damage *in vivo* to the Folded Chromosome of *Escherichia coli*, Chem.-Biol. Interactions, **43**, 245-251 (1983).
- (108) T. G. Heckler, Y. Zama, T. Naka and S. M. Hecht, Dipeptide Formation with Misacylated tRNA<sup>Phe</sup>s, J. Biol. Chem., **258**, 4492-4495 (1983).
- (109) H. Sasamori, K. S. Reddy, M. P. Kirkup, J. Shabanowitz, D. G. Lynn, S. M. Hecht, K. A. Woode, R. F. Bryan, J. Campbell, W. S. Lynn, E. Egert and G. Sheldrick, New Cytotoxic Principles from *Datisca glomerata*, JCS Perkin Trans. 1, 1333-1347 (1983).
- (110) W. D. Henner, L. O. Rodriguez, S. M. Hecht and W. A. Haseltine,  $\gamma$  Ray Induced Deoxyribonucleic Acid Strand Breaks: 3'-Glycolate Termini, J. Biol. Chem., **258**, 711-713 (1983).
- (111) T. A. Francis, G. M. Ehrenfeld, M. R. Gregory and S. M. Hecht, Transfer RNA Pyrophosphorolysis with CTP(ATP): tRNA Nucleotidyltransferase. A Direct Route to tRNA's Modified at the 3'-Terminus, J. Biol. Chem., **258**, 4279-4284 (1983).
- (112) G. M. Ehrenfeld, T. A. Francis, and S. M. Hecht, Loss of Positional Specificity in the Aminoacylation of *E. coli* tRNA<sup>Gly</sup>, J. Biol. Chem., **258**, 11745-11750 (1983).
- (113) S. D. Fang, D. E. Berry, D. G. Lynn, S. M. Hecht, J. Campbell and W. S. Lynn, The Chemistry of Toxic Principles from *Maytenus nemerosa*, Phytochemistry, **23**, 631-633 (1984).
- (114) T. G. Heckler, L.-H. Chang, Y. Zama, T. Naka and S. M. Hecht, Preparation of 2'-(3')-O-Acyl-pCpA Derivatives as Substrates for T4 RNA Ligase-Mediated "Chemical Aminoacylation", Tetrahedron, **40**, 87-94 (1984).

- (115) T. G. Heckler, L.-H. Chang, Y. Zama, T. Naka, M. S. Chorghade and S. M. Hecht, T4 RNA Ligase Mediated Preparation of Novel "Chemically Misacylated" tRNA<sup>Phe</sup>s, Biochemistry, **23**, 1468-1473 (1984).
- (116) G. M. Ehrenfeld, N. Murugesan and S. M. Hecht, Activation of Oxygen and Mediation of DNA Degradation by Manganese-Bleomycin, Inorg. Chem., **23**, 1496-1498 (1984).
- (117) K. S. Reddy, M. S. Shekhani, D. E. Berry, D. G. Lynn and S. M. Hecht, Afromontoside. A New Cytotoxic Principle from *Dracaena afromontana*. J.C.S. Perkins Trans., **1**, 987-992 (1984).
- (118) R. E. Kilkuskie, T. L. Macdonald and S. M. Hecht, Bleomycin May be Activated for DNA Cleavage by NADPH-Cytochrome P-450 Reductase, Biochemistry, **23**, 6165-6171 (1984).
- (119) X. Fang, C. H. Phoebe, Jr., J. M. Pezzuto, H. H. S. Fong, N. R. Farnsworth, B. Yellin and S. M. Hecht, Plant Anticancer Agents XXXIV. Cucurbitacins from *Elaeocarpus dolichostylus*, J. Nat. Prod., **47**, 988-993 (1984).
- (120) N. Murugesan and S. M. Hecht, Bleomycin as an Oxene Transferase. Catalytic Oxygen Transfer to Olefins, J. Am. Chem. Soc., **107**, 493-500 (1985).
- (121) G. M. Ehrenfeld, L. O. Rodriguez, S. M. Hecht, C. Chang, V. J. Basus and N. J. Oppenheimer, Copper(I)-Bleomycin: Structurally Unique Complex that Mediates Oxidative DNA Strand Scission, Biochemistry, **24**, 81-92 (1985).
- (122) R. E. Kilkuskie, H. Suguna, B. Yellin, N. Murugesan and S. M. Hecht, Oxygen Transfer by Bleomycin Analogs Dysfunctional in DNA Cleavage, J. Am. Chem. Soc., **107**, 260-261 (1985).
- (123) D. E. Berry, L.-H. Chang and S. M. Hecht, DNA Damage and Growth Inhibition in Cultured Human Cells by Bleomycin Congeners, Biochemistry, **24**, 3207-3214 (1985).
- (124) D. E. Berry, R. E. Kilkuskie and S. M. Hecht, DNA Damage Induced by Bleomycin in the Presence of Dibucaine is not Predictive of Cell Growth Inhibition, Biochemistry, **24**, 3214-3219 (1985).
- (125) H. Sugiyama, C. Xu, N. Murugesan and S. M. Hecht, Structure of the Alkali-Labile Product Formed During Fe(II)•Bleomycin-Mediated DNA Strand Scission, J. Am. Chem. Soc., **107**, 4104-4105 (1985).
- (126) C. Che, X. Fang, C. H. Phoebe, Jr., A. D. Kinghorn, N. R. Farnsworth, B. Yellin and S. M. Hecht, High Field <sup>1</sup>H-NMR Spectral Analysis of Some Cucurbitacins, J. Nat. Prod., **48**, 429-434 (1985).
- (127) R. P. Hertzberg, M. J. Caranfa and S. M. Hecht, DNA Methylation Diminishes Bleomycin-Mediated DNA Strand Scission, Biochemistry, **24**, 5285-5289 (1985).
- (128) N. Murugesan, C. Xu, G. M. Ehrenfeld, H. Sugiyama, A. E. Kilkuskie, L. O. Rodriguez, L.-H. Chang and S. M. Hecht, Analysis of Products Formed During Bleomycin-Mediated DNA Degradation, Biochemistry, **24**, 5735-5744 (1985).

- (129) Y.-H. Hsiang, R. Hertzberg, S. M. Hecht and L. F. Liu, Camptothecin Induces Protein-Linked DNA Breaks via Mammalian DNA Topoisomerase I, J. Biol. Chem., **260**, 14873-14878 (1985).
- (130) H. Sugiyama, R. E. Kilkuskie, S. M. Hecht, G. A. van der Marel and J. H. van Boom, An Efficient, Site-Specific DNA Target for Bleomycin, J. Am. Chem. Soc., **107**, 7765-7767 (1985).
- (131) K. Katano, P.-I. Chang, A. Millar, V. Pozsgay, D. K. Minster, T. Ohgi and S. M. Hecht, Synthesis of the Carbohydrate Moiety of Bleomycin. 1,3,4,6-Tetra-O-Substituted-L-Gulose Derivatives, J. Org. Chem., **50**, 5807-5815 (1985).
- (132) H. Sugiyama, G. M. Ehrenfeld, J. B. Shipley, R. E. Kilkuskie, L.-H. Chang and S. M. Hecht, DNA Strand Scission by Bleomycin Group Antibiotics, J. Nat. Prod., **48**, 869-877 (1985).
- (133) A. Millar, K. H. Kim, D. K. Minster, T. Ohgi and S. M. Hecht, Synthesis of the Carbohydrate Moiety of Bleomycin. 2,3,4,6-Tetra-O-Substituted-D-Mannose Derivatives, J. Org. Chem., **51**, 189-196 (1986).
- (134) R. P. Hertzberg, S. M. Hecht, V. L. Reynolds, I. J. Molineux and L. H. Hurley, DNA Sequence Specificity of the Pyrrolo[1,4]benzodiazepine Antitumor Antibiotics. Methidiumpropyl-EDTA-Iron(II) Footprinting Analysis of DNA Binding Sites for Anthramycin and Related Drugs, Biochemistry, **25**, 1249-1258 (1986).
- (135) H. Sugiyama, R. E. Kilkuskie, L.-H. Chang, L.-T. Ma, S. M. Hecht, G. A. van der Marel and J. H. van Boom, DNA Strand Scission by Bleomycin: Catalytic Cleavage and Strand Selectivity, J. Am. Chem. Soc., **108**, 3852-3854 (1986).
- (136) K. Katano, A. Millar, V. Pozsgay, J. L. Primeau and S. M. Hecht, Synthesis of the Disaccharide Moiety of Bleomycin. 2-O-(3-O-Carbamoyl- $\alpha$ -D-mannopyranosyl)-L-gulopyranose Derivatives, J. Org. Chem., **51**, 2927-2932 (1986).
- (137) S. M. Hecht, DNA Strand Scission by Activated Bleomycin Group Antibiotics, Fed. Proc., **45**, 2784-2791 (1986).
- (138) J. R. Roesser, M. S. Chorghade and S. M. Hecht, Ribosome-Catalyzed Formation of an Abnormal Peptide Analog, Biochemistry, **25**, 6361-6365 (1986).
- (139) D. C. Heimbrook, R. L. Mulholland and S. M. Hecht, Multiple Pathways in the Oxidation of *cis*-Stilbene by Fe•Bleomycin, J. Am. Chem. Soc., **108**, 7839-7840 (1986).
- (140) S. M. Hecht, The Chemistry of Activated Bleomycin, Acc. Chem. Res., **19**, 383-391 (1986).
- (141) G. M. Ehrenfeld, J. B. Shipley, D. C. Heimbrook, H. Sugiyama, E. C. Long, J. H. van Boom, G. A. van der Marel, N. J. Oppenheimer and S. M. Hecht, Copper Dependent Cleavage of DNA by Bleomycin, Biochemistry, **26**, 931-942 (1987).
- (142) R. C. Payne, B. P. Nichols and S. M. Hecht, *Escherichia coli* Tryptophan Synthase: Synthesis of Catalytically Competent  $\alpha$  Subunit in a Cell Free System Containing Preacylated tRNA's, Biochemistry, **26**, 3197-3205 (1987).

- (143) D. C. Heimbrook, S. A. Carr, M. A. Mentzer, E. C. Long and S. M. Hecht, On the Mechanism of Oxygenation of *cis*-Stilbene by Fe•Bleomycin, Inorg. Chem., **26**, 3835-3836 (1987).
- (144) H. Sugiyama, C. Xu, N. Murugesan, S. M. Hecht, G. A. van der Marel and J. H. van Boom, Chemistry of the Alkali-Labile Lesion Formed from Iron(II) Bleomycin and d(CGCTTTAAAGCG), Biochemistry, **27**, 58-67 (1988).
- (145) L. A. Chrisey, G. H. Shahidi Bonjar and S. M. Hecht, DNA Strand Scission by (-)Epicatechin and Procyanidin B<sub>2</sub>, J. Am. Chem. Soc., **110**, 644-646 (1988).
- (146) J. B. Shipley and S. M. Hecht, Bleomycin Congeners Exhibiting Altered DNA Cleavage Specificity, Chem. Res. Toxicol., **1**, 25-27 (1988).
- (147) B. Gold, V. Dange, M. A. Moore, A. Eastman, G. A. van der Marel, J. H. van Boom and S. M. Hecht, Alteration of Bleomycin Cleavage Specificity in a Platinated DNA Oligomer of Defined Structure, J. Am. Chem. Soc., **110**, 2347-2349 (1988).
- (148) M. J. Levy and S. M. Hecht, Cu(II) Facilitates Bleomycin-Mediated Unwinding of Plasmid DNA, Biochemistry, **27**, 2647-2650 (1988).
- (149) R. P. Hertzberg, M. J. Caranfa and S. M. Hecht, Degradation of Structurally Modified DNA's by Bleomycin Group Antibiotics, Biochemistry, **27**, 3164-3174 (1988).
- (150) J. D. Leber, J. R. E. Hoover, K. G. Holden, R. K. Johnson and S. M. Hecht, A Revised Structure for Sibiromycin, J. Am. Chem. Soc., **110**, 2992-2993 (1988).
- (151) R. T. Scannell, J. R. Barr, V. S. Murty, K. S. Reddy and S. M. Hecht, DNA Strand Scission by Naturally Occurring 5-Alkylresorcinols, J. Am. Chem. Soc., **110**, 3650-3651 (1988).
- (152) S. M. Hecht, DNA Strand Scission by Activated Bleomycin Group Antibiotics, in "Anticarcinogenesis and Radiation Protection", P. A. Cerutti, O. F. Nygaard and M. G. Simic, Eds., Plenum Press, New York, 1988, p. 437-440.
- (153) J. R. Barr, V. S. Murty, K. Yamaguchi, D. H. Smith and S. M. Hecht, 5-Alkylresorcinols from *Hakea Amplexicaulis* that Cleave DNA, Chem. Res. Toxicol., **1**, 204-207 (1988).
- (154) A. Jäger, M. J. Levy and S. M. Hecht, Oligodeoxynucleotide N-Alkylphosphoramidates: Synthesis and Binding to Polynucleotides, Biochemistry, **27**, 7237-7246 (1988).
- (155) T. G. Heckler, J. R. Roesser, C. Xu, P.-I. Chang and S. M. Hecht, Ribosomal Binding and Dipeptide Formation by Misacylated tRNA<sup>Phe</sup>s, Biochemistry, **27**, 7254-7262 (1988).
- (156) E. C. Long and S. M. Hecht, Direct Comparison of Oxygen Transfer by Iron Bleomycin and Zinc Bleomycin, Tetrahedron Lett., **29**, 6413-6416 (1988).
- (157) S. M. Hecht, Natural Products that Cleave DNA, Pure Appl. Chem., **61**, 577-580 (1989).
- (158) S. M. Sebt, J. C. DeLeon, L.-T. Ma, S. M. Hecht and J. S. Lazo, Substrate Specificity of Bleomycin Hydrolase, Biochem. Pharmacol., **38**, 141-147 (1989).

- (159) I. Saito, T. Morii, H. Sugiyama, T. Matsuura, C. F. Meares, and S. M. Hecht, Photo-induced DNA Strand Scission by Cobalt Bleomycin Green Complex, J. Am. Chem. Soc., **111**, 2307-2308 (1989).
- (160) R. B. Van Atta, E. C. Long, S. M. Hecht, G.A. van der Marel, and J. H. van Boom, Electrochemical Activation of Oxygenated Fe•Bleomycin, J. Am. Chem. Soc., **111**, 2722-2724 (1989).
- (161) R.P. Hertzberg, M. J. Caranfa, and S. M. Hecht, On the Mechanism of Topoisomerase I Inhibition by Camptothecin: Evidence for Binding to an Enzyme-DNA Complex, Biochemistry, **28**, 4629-4638 (1989).
- (162) J. R. Roesser, C. Xu, R. C. Payne, C. K. Surratt and S. M. Hecht, Preparation of Misacylated Aminoacyl-tRNA<sup>Phe</sup>'s Useful as Probes of the Ribosomal Acceptor Site, Biochemistry, **28**, 5185-5195 (1989).
- (163) C. K. Surratt, B. J. Carter, and S. M. Hecht, Processing of a Synthetic tRNA Precursor Model by *E. coli* RNase P and M1 RNA in "UCLA Symposium on the "Molecular Biology of RNA", Volume 94, T. Cech, Ed., A. R. Liss, Inc., 1989, pp 79-88.
- (164) S. M. Hecht, Bleomycin: Studies on the Mechanism of Action of an Antitumor Antibiotic, in "Molecular Aspects of Human Diseases", J. W. Gorrod, O. Albano, and S. Papa, Eds., Ellis Horwood, Ltd., 1989, pp 24-32.
- (165) S. M. Hecht, The Chemistry of Activated Bleomycin, in "The Chemistry of Antitumor Agents", D. E. V. Wilman, Ed., Blackie and Son Limited, Glasgow, 1990, pp 395-402.
- (166) B. J. Carter, V. S. Murty, K. S. Reddy, S.-N. Wang, and S. M. Hecht, A Role for the Metal Binding Domain of Bleomycin in Determining the DNA Sequence Selectivity of Fe-Bleomycin, J. Biol. Chem., **265**, 4193-4196 (1990).
- (167) A. Natrajan, S. M. Hecht, G. A. van der Marel and J. H. van Boom, A Study of O<sub>2</sub> vs H<sub>2</sub>O<sub>2</sub>-Supported Activation of Fe•Bleomycin, J. Am. Chem. Soc., **112**, 3997-4002 (1990).
- (168) B. J. Carter, B. S. Vold and S. M. Hecht, Control of the Position of RNase P-Mediated Transfer RNA Precursor Processing, J. Biol. Chem., **265**, 7100-7103 (1990).
- (169) J. R. Barr, R. B. Van Atta, A. Natrajan, S. M. Hecht, G. A. van der Marel and J. H. van Boom, Fe(II)•BLM-Mediated Reduction of O<sub>2</sub> to H<sub>2</sub>O: An <sup>17</sup>O-NMR Study, J. Am. Chem. Soc., **112**, 4058-4060 (1990).
- (170) V. Dange, R. B. Van Atta and S. M. Hecht, A Mn<sup>2+</sup>-Dependent Ribozyme, Science, **248**, 585-588 (1990).
- (171) A. Natrajan, S. M. Hecht, G. A. van der Marel and J. H. van Boom, Activation of Fe(II)•BLM by 10-Hydroperoxy-8, 12-octadecadienoic Acid, J. Am. Chem. Soc., **112**, 4532-4538 (1990).
- (172) R. B. Van Atta, J. Bernadou, B. Meunier, and S. M. Hecht, On the Chemical Nature of DNA and RNA Modification by a Hemin Model System, Biochemistry, **29**, 4783-4789 (1990).



- (173) B. K. Carté, C. DeBrosse, D. Eggleston, M. Hemling, M. Mentzer, B. Poehland, N. Troupe, J. W. Westley and S. M. Hecht, Isolation and Characterization of a Presumed Biosynthetic Precursor of Camptothecin from Extracts of *Camptotheca Acuminata*, Tetrahedron, **46**, 2747-2760 (1990).
- (174) E. C. Long, S. M. Hecht, G. A. van der Marel and J. H. van Boom, Interaction of Bleomycin with a Methylated DNA Oligonucleotide, J. Am. Chem. Soc., **112**, 5272-5276 (1990).
- (175) S. M. Hecht, E. C. Long, R. B. Van Atta, E. de Vroom and B. J. Carter, On the Mechanism of Bleomycin Activation and Polynucleotide Strand Scission, in "Molecular Mechanisms in BioOrganic Processes", C. Beasdale and B. T. Golding, Eds., Royal Society of Chemistry, 1990, pp 100-114.
- (176) B. J. Carter, E. de Vroom, E. C. Long, G. A. van der Marel, J. H. van Boom and S. M. Hecht, Site-Specific Cleavage of RNA by Fe(II)•Bleomycin, Proc. Natl. Acad. Sci. USA, **87**, 9373-9377 (1990).
- (177) R. P. Hertzberg, R. W. Busby, M. J. Caranfa, K. G. Holden, R. K. Johnson, S. M. Hecht and W. D. Kingsbury, Irreversible Trapping of the DNA - Topoisomerase I Covalent Complex. Affinity Labeling of the Camptothecin Binding Site, J. Biol. Chem., **265**, 19287-19295 (1990).
- (178) Y. Aoyagi, M. S. Chorghade, A. A. Padmapriya, H. Suguna, and S. M. Hecht, Synthesis of Pyrimidoblamic Acid and Epipyrimidoblamic Acid, J. Org. Chem., **55**, 6291-6298 (1990).
- (179) C. K. Surratt, Z. Lesnikowski, A. L. Schiffman, F. J. Schmidt, and S. M. Hecht, Construction and Processing of Transfer RNA Precursor Models, J. Biol. Chem., **265**, 22506-22512 (1990).
- (180) C. K. Surratt, B. J. Carter, R. C. Payne and S. M. Hecht, Metal Ion and Substrate Structure Dependence of the Processing of tRNA Precursors by RNase P and M1 RNA, J. Biol. Chem., **265**, 22513-22519 (1990).
- (181) W. D. Kingsbury, J. C. Boehm, D. R. Jakas, K. G. Holden, S. M. Hecht, G. Gallagher, M. J. Caranfa, F. L. McCabe, L. F. Faucette, R. K. Johnson and R. P. Hertzberg, Synthesis of Water-Soluble Aminoalkylcamptothecin Analogues: Inhibition of Topoisomerase I and Antitumor Activity, J. Med. Chem., **34**, 98-107 (1991).
- (182) B. J. Carter, K. S. Reddy and S. M. Hecht, Polynucleotide Recognition and Strand Scission by Fe•Bleomycin, Tetrahedron, **47**, 2463-2474 (1991).
- (183) D. E. Berry, J. A. Chan, L. MacKenzie and S. M. Hecht, 9-Octadecynoic Acid: A Novel DNA Binding Agent, Chem. Res. Toxicol., **4**, 195-198 (1991).
- (184) B. J. Carter, C. E. Holmes, R. B. Van Atta, V. Dange and S. M. Hecht, Metal-Catalyzed Polynucleotide Strand Scission, Nucleosides & Nucleotides, **10**, 215-227 (1991).
- (185) R. P. Hertzberg, M. J. Caranfa, W. D. Kingsbury, B. Smith, R. K. Johnson and S. M. Hecht, The Biochemistry of Camptothecin-Topoisomerase I Interaction, in "DNA Topoisomerases in Cancer", M. Potmesil and K.W. Kohn Eds., Oxford University Press, New York, 1991, pp 103-120.

- (186) K. Nagai, B. J. Carter, J. Xu and S. M. Hecht, DNA Cleavage by Oxygen Radicals Produced in the Absence of Metal Ions or Light, J. Am. Chem. Soc., **113**, 5099-5100 (1991).
- (187) A. Natrajan and S. M. Hecht, Production of 2-Octenyl Radicals from the Fe(III)•Bleomycin-Mediated Fragmentation of 10-Hydroperoxy-8,12-octadecadienoic Acid, J. Org. Chem., **56**, 5239-5241 (1991).
- (188) K. Nagai and S. M. Hecht, Site-Specific DNA Cleavage by Antisense Oligonucleotides Covalently Linked to Phenazine Di-N-oxide, J. Biol. Chem., **266**, 23994-24002 (1991).
- (189) D. E. Berry, L. MacKenzie, E. A. Shultis, J. A. Chan and S. M. Hecht, Naturally Occurring Inhibitors of Topoisomerase I-Mediated DNA Relaxation, J. Org. Chem., **57**, 420-422 (1992).
- (190) S. M. Hecht, D. E. Berry, L. J. MacKenzie, R. W. Busby and C. A. Nasuti, A Strategy for Identifying Novel, Mechanistically Unique Inhibitors of Topoisomerase I, J. Nat. Prod., **55**, 401-413 (1992).
- (191) N. Hamamichi, A. Natrajan and S. M. Hecht, On the Role of Individual Bleomycin Thiazoles in Oxygen Activation and DNA Cleavage, J. Am. Chem. Soc., **114**, 6278-6291 (1992).
- (192) E. Resto, A. Iida, M. D. Van Cleve and S. M. Hecht, Amplification of Protein Expression in a Cell Free System, Nucleic Acids Res., **20**, 5979-5983 (1992).
- (193) S. M. Hecht, Probing the Synthetic Capabilities of a Center of Biochemical Catalysis, Acc. Chem. Res., **25**, 545-552 (1992).
- (194) R. Van Atta and S. M. Hecht, A Ribozyme Model: Site-Specific Cleavage of an RNA Substrate by Mn<sup>2+</sup>, Adv. Inorg. Biochem., **9**, 1-40 (1993).
- (195) M. L. Sznajdman, C. Crasto and S. M. Hecht, A New Method for the Synthesis of Nitriles from Amides Under Non-Acidic Conditions, Tetrahedron Lett., **34**, 1581-1584 (1993).
- (196) C. E. Holmes, B. J. Carter and S. M. Hecht, Characterization of Fe(II)•Bleomycin-Mediated RNA Strand Scission, Biochemistry, **32**, 4293-4307 (1993).
- (197) R. J. Duff, E. de Vroom, A. Geluk, S. M. Hecht, G. A. van der Marel and J. H. van Boom, Evidence for C-1' H Abstraction from Modified Oligonucleotides by Fe•Bleomycin, J. Am. Chem. Soc., **115**, 3350-3351 (1993).
- (198) S.-D. Fang, L.-K. Wang and S. M. Hecht, Inhibitors of DNA Topoisomerase I Isolated from the Roots of *Zanthoxylum nitidum*, J. Org. Chem., **58**, 5025-5027 (1993).
- (199) L.-K. Wang, R. K. Johnson and S. M. Hecht, Inhibition of Topoisomerase I-Mediated DNA Cleavage by Nitidine and Fagaronine, Chem. Res. Toxicol., **6**, 813-818 (1993).
- (200) C. E. Holmes and S. M. Hecht, Fe•Bleomycin Cleaves a Transfer RNA Precursor and its "Transfer DNA" Analog at the Same Major Site, J. Biol. Chem., **268**, 25909-25913 (1993).
- (201) J. C. Quada, Jr., M. J. Levy and S. M. Hecht, Highly Efficient DNA Strand Scission by Photoactivated Chlorobithiazoles, J. Am. Chem. Soc., **115**, 12171-12172 (1993).

- (202) N. Hamamichi and S. M. Hecht, Determination of the Absolute Configuration of the Thiazolinythiazole Moiety of Phleomycin, J. Am. Chem. Soc., **115**, 12605-12606 (1993).
- (203) A. Natrajan and S. M. Hecht, Bleomycins: Mechanism of Polynucleotide Recognition and Oxidative Degradation, in "Molecular Aspects of Anticancer Drug-DNA Interactions", Vol. 2, S. Neidle and M. J. Waring, Eds., Macmillan Press, London, 1994, pp 197-242.
- (204) S. A. Kane, A. Natrajan and S. M. Hecht, On the Role of the Bithiazole Moiety in Sequence Selective DNA Cleavage by Fe•Bleomycin, J. Biol. Chem., **269**, 10899-10904 (1994).
- (205) M. Overhand and S. M. Hecht, A Concise Synthesis of the Antifungal Agent (+)-Preussin, J. Org. Chem., **59**, 4721-4722 (1994).
- (206) M. A. Morgan and S. M. Hecht, Iron(II)Bleomycin-Mediated Degradation of a DNA-RNA Heteroduplex, Biochemistry, **33**, 10286-10293 (1994).
- (207) S. M. Hecht, D. E. Berry, L. J. MacKenzie, E. A. Shultis, and J. A. Chan, A Strategy for Identifying Novel Inhibitors of DNA Topoisomerase I, in "Anticancer Drug Discovery and Development; Natural Products and New Molecular Models", F. Valeriote, T. H. Corbett, and L. H. Baker, Eds., Kluwer, Boston, 1994, pp 85-94.
- (208) S. M. Hecht, RNA Degradation by Bleomycin, a Naturally Occurring Bioconjugate, Bioconjugate Chem., **5**, 513-526 (1994).
- (209) R. A. Manderville, J. F. Ellena and S. M. Hecht, Solution Structure of a Zn(II)•Bleomycin A<sub>5</sub>-d(CGCTAGCG)<sub>2</sub> Complex, J. Am. Chem. Soc., **116**, 10851-10852 (1994).
- (210) S. A. Kane and S. M. Hecht, Polynucleotide Recognition and Degradation by Bleomycin, Prog. Nucleic Acid Res. Mol. Biol., **49**, 313-352 (1994).
- (211) S. A. Kazakov and S. M. Hecht, Metal-Nucleic Acid Interactions, in "Encyclopedia of Inorganic Chemistry", R. B. King, Ed., John Wiley, London, 1994, pp 2697-2720.
- (212) S. M. Hecht, Bleomycin Group Antitumor Agents, in "Cancer Chemotherapeutic Agents", W. O. Foye, Ed., American Chemical Society, Washington, DC, 1995, pp 369-388.
- (213) K. A. Henningfeld and S. M. Hecht, Topoisomerase I-Mediated Illegitimate Recombination with Duplex DNA Substrates Containing Branches, Nicks and Gaps, Biochemistry, **34**, 6120-6129 (1995).
- (214) M. L. Sznajdman, S. C. Johnson, C. Crasto and S. M. Hecht, Carbohydrate Cyclic Ketene Acetals, J. Org. Chem., **60**, 3942-3943 (1995).
- (215) R. A. Manderville, J. F. Ellena and S. M. Hecht, Interaction of Zn(II)•Bleomycin with d(CGCTAGCG)<sub>2</sub>. A Binding Model Based on NMR Experiments and Restrained Molecular Dynamics Calculations, J. Am. Chem. Soc., **117**, 7891-7903 (1995).

- (216) S. A. Kane, H. Sasaki and S. M. Hecht, Guanosine-Specific DNA Damage by a Co(II)•Bithiazole Complex, J. Am. Chem. Soc., **117**, 9107-9118 (1995).
- (217) M. V. Keck and S. M. Hecht, Sequence-Specific Hydrolysis of Yeast tRNA<sup>Phe</sup> Mediated by Metal Free Bleomycin, Biochemistry, **34**, 12029-12037 (1995).
- (218) M. A. Morgan, S. A. Kazakov and S. M. Hecht, Phosphoryl Migration During the Chemical Synthesis of RNA, Nucleic Acids Res., **23**, 3949-3953 (1995).
- (219) W. Lytollis, R. T. Scannell, H. An, V. S. Murty, K. S. Reddy, J. R. Barr and S. M. Hecht, 5-Alkylresorcinols from *Hakea trifurcata* that Cleave DNA, J. Am. Chem. Soc., **117**, 12683-12690 (1995).
- (220) U. S. Singh, R. T. Scannell, H. An, B. J. Carter and S. M. Hecht, DNA Cleavage by Di- and Trihydroxyalkylbenzenes. Characterization of the Roles of O<sub>2</sub>, Cu(II) and Alkali, J. Am. Chem. Soc., **117**, 12691-12699 (1995).
- (221) S. A. Kane, S. M. Hecht, J.-S. Sun, T. Garestier and C. Hélène, Specific Cleavage of a DNA Triple Helix by Fe<sup>II</sup>•Bleomycin, Biochemistry, **34**, 16715-16724 (1995).
- (222) L.-K. Wang, B. D. Rogers and S. M. Hecht, Inhibition of Topoisomerase I Function by Coralyne and 5,6-Dihydrocoralyne, Chem. Res. Toxicol., **9**, 75-83 (1996).
- (223) S. M. Hecht, Polynucleotide Cleavage and the Expression of Antitumor Activity by Bleomycin, NATO ASI Ser., Ser. C, **479**, 77-89 (1996).
- (224) S. V. Mamaev, A. L. Laikhter, T. Arslan and S. M. Hecht, Firefly Luciferase: Alteration of the Color of Emitted Light Resulting from Substitutions at Position 286, J. Am. Chem. Soc., **118**, 7243-7244 (1996).
- (225) C. E. Holmes, A. T. Abraham, S. M. Hecht, C. Florentz and R. Giegé, Fe•Bleomycin as a Probe of RNA Conformation, Nucleic Acids Res., **24**, 3399-3406 (1996).
- (226) K. A. Henningfeld, T. Arslan and S. M. Hecht, Alteration of DNA Primary Structure by DNA Topoisomerase I. Isolation of the Covalent Topoisomerase I - DNA Binary Complex in Enzymatically Competent Form, J. Am. Chem. Soc., **118**, 11701-11714 (1996).
- (227) E. P. Locke and S. M. Hecht, Enantiospecific Total Synthesis of (+) and (-)-Avarone and Avarol, J. Chem. Soc., Chem. Commun., 2717-2718 (1996).
- (228) M. Lodder, S. Golovine and S. M. Hecht, A. Chemical Deprotection Strategy for the Elaboration of Misacylated Transfer RNA's, J. Org. Chem., **62**, 778-779 (1997).
- (229) C. E. Holmes, R. J. Duff, G. A. van der Marel, J. van Boom and S. M. Hecht, On the Chemistry of RNA Degradation by Fe(II)•BLM, Bioorg. Med. Chem., **5**, 1235-1248 (1997).
- (230) V. A. Karginov, S. V. Mamaev, H. An, M. D. Van Cleve, S. M. Hecht, G. A. Komatsoulis and J. N. Abelson, Probing the Role of an Active Site Aspartic Acid in Dihydrofolate Reductase, J. Am. Chem. Soc., **119**, 8166-8176 (1997).
- (231) V. A. Karginov, S. V. Mamaev and S. M. Hecht, *In Vitro* Suppression as a Tool for the Investigation of Translation Initiation, Nucleic Acids Res., **25**, 3912-3916 (1997).

- (232) T. Arslan, S. V. Mamaev, N. V. Mamaeva and S. M. Hecht, Structurally Modified Firefly Luciferase. Effects of Amino Acid Substitution at Position 286, J. Am. Chem. Soc., **119**, 10877-10887 (1997).
- (233) S. M. Hecht, RNA as a Therapeutic Target for Bleomycin, in "The Many Faces of RNA", D. S. Eggleston, C. D. Prescott and N. D. Pearson, Eds., Academic Press Ltd., London, 1998, pp 3-17.
- (234) M. Lodder, S. Golovine, A. L. Laikhter, V. A. Karginov and S. M. Hecht, Misacylated Transfer RNAs Having a Chemically Removable Protecting Group, J. Org. Chem., **63**, 794-803 (1998).
- (235) K. E. Loeb, J. M. Zaleski, C. D. Hess, S. M. Hecht and E. I. Solomon, Spectroscopic Investigation of the Metal Ligation and Reactivity of the Ferrous Active Sites of Bleomycin and Bleomycin Derivatives, J. Am. Chem. Soc., **120**, 1249-1259 (1998).
- (236) T. Arslan, A. T. Abraham and S. M. Hecht, Structurally Altered Substrates for DNA Topoisomerase I. Effects of Inclusion of a Single 3'-Deoxynucleotide within the Scissile Strand, Nucleosides & Nucleotides, **17**, 515-530 (1998).
- (237) X.-Y. Wang, K. A. Henningfeld and S. M. Hecht, DNA Topoisomerase I-Mediated Formation of Structurally Modified DNA Duplexes. Effects of Metal Ions and Topoisomerase I Inhibitors, Biochemistry, **37**, 2691-2700 (1998).
- (238) J. A. Killian, M. D. Van Cleve, Y. F. Shayo and S. M. Hecht, Ribosome-Mediated Incorporation of Hydrazinophenylalanine into Modified Peptide and Protein Analogues, J. Am. Chem. Soc., **120**, 3032-3042 (1998).
- (239) S. C. Johnson, C. Crasto and S. M. Hecht, Facial Selectivity in the Cycloaddition of Heterodienes to Carbohydrate Cyclic Ketene Acetals. A Novel Synthesis of Disaccharide Derivatives, J. Chem. Soc., Chem. Commun., 1019-1020 (1998).
- (240) T. Arslan, A. T. Abraham and S. M. Hecht, DNA Duplexes Containing 3'-Deoxynucleotides as Substrates for DNA Topoisomerase I Cleavage and Ligation, J. Biol. Chem., **273**, 12383-12390 (1998).
- (241) J. C. Quada, Jr., G. F. Zuber and S. M. Hecht, Interaction of Bleomycin with DNA, Pure Appl. Chem., **70**, 307-311 (1998).
- (242) X.-Y. Wang, L.-K. Wang, W. D. Kingsbury, R. K. Johnson and S. M. Hecht, Differential Effects of Camptothecin Derivatives on Topoisomerase I-Mediated DNA Structure Modification, Biochemistry, **37**, 9399-9408 (1998).
- (243) S. J. Sucheck, J. F. Ellena and S. M. Hecht, Characterization of Zn(II)•Deglycobleomycin A<sub>2</sub> and Interaction with d(CGCTAGCG)<sub>2</sub>. Direct Evidence for Minor Groove Binding of the Bithiazole Moiety, J. Am. Chem. Soc., **120**, 7450-7460 (1998).
- (244) G. Zuber, J. C. Quada, Jr. and S. M. Hecht, Sequence Selective Cleavage of a DNA Octanucleotide by Chlorinated Bithiazoles and Bleomycins, J. Am. Chem. Soc., **120**, 9368-9369 (1998).

- (245) S. M. Hecht, B. Wang, S. V. Mamaev, T. Arslan, G. F. Short, III, M. Lodder and S. Golovine, Misacylated tRNAs: A Source of Structurally Modified Peptides and Proteins, Nucleic Acids Res., Symp. Ser., **39**, 15-16 (1998).
- (246) K. Katano, H. An, Y. Aoyagi, M. Overhand, S. J. Sucheck, W. C. Stevens, Jr., C. D. Hess, X. Zhou and S. M. Hecht, Total Synthesis of Bleomycin Group Antibiotics. Total Syntheses of Bleomycin Demethyl A<sub>2</sub>, Bleomycin A<sub>2</sub> and Decarbamoyl Bleomycin Demethyl A<sub>2</sub>, J. Am. Chem. Soc., **120**, 11285-11296 (1998).
- (247) X.-Y. Wang, G. F. Short, III, W.D. Kingsbury, R. K. Johnson and S. M. Hecht, Effects of Camptothecin Analogues on DNA Transformations Mediated by Calf Thymus and Human DNA Topoisomerases I, Chem. Res. Toxicol., **11**, 1352-1360 (1998).
- (248) J. Chen, Y.-H. Zhang, L.-K. Wang, S. J. Sucheck, A. M. Snow and S. M. Hecht, Inhibitors of DNA Polymerase  $\beta$  from *Schoepfia Californica*, J. C. S. Chem. Commun., 2769-2770 (1998).
- (249) G. F. Short, III, M. Lodder, A. L. Laikhter, T. Arslan and S. M. Hecht, Caged HIV-1 Protease: Dimerization is Independent of the Ionization State of the Active Site Aspartates, J. Am. Chem. Soc., **121**, 478-479 (1999).
- (250) A. T. Abraham, X. Zhou and S. M. Hecht, DNA Cleavage by Fe(II)•Bleomycin Conjugated to a Solid Support, J. Am. Chem. Soc., **121**, 1982-1983 (1999).
- (251) X.-Y. Wang, X. Zhou and S. M. Hecht, Role of the 20-Hydroxyl Group in Camptothecin Binding by the Topoisomerase I-DNA Binary Complex, Biochemistry, **38**, 4374-4381 (1999).
- (252) J.-Z. Deng, S. R. Starck and S. M. Hecht, Bis-5-Alkylresorcinols from *Panopsis rubescens* that Inhibit DNA Polymerase  $\beta$ , J. Nat. Prod., **62**, 477-480 (1999).
- (253) J.-Z. Deng, D.-A. Sun, S. R. Starck, S. M. Hecht, R. L. Cerny and J. R. Engen Chrysochlamic Acid, A New Diterpenoid Substituted Quinol from *Chrysochlamys Ulei* that Inhibits DNA Polymerase  $\beta$ , J. Chem. Soc., Perkin Trans. 1, 1147-1149 (1999).
- (254) G. F. Short, III, S. Y. Golovine and S. M. Hecht, Effects of Release Factor 1 on *In Vitro* Protein Translation and the Elaboration of Proteins Containing Unnatural Amino Acids, Biochemistry, **38**, 8808-8819 (1999).
- (255) D.-A. Sun, J.-Z. Deng, S. R. Starck and S. M. Hecht, Misprylic Acid, a New Monocyclic Triterpenoid with a Novel Skeleton from *Mischocarpus Pyriformis* that Inhibits DNA Polymerase  $\beta$ , J. Am. Chem. Soc., **121**, 6120-6124 (1999).
- (256) J.-Z. Deng, S. R. Starck, S. M. Hecht, C. F. Ijames and M. Hemling, Harbinatic Acid, a Novel and Potent DNA Polymerase  $\beta$  Inhibitor from *Hardwickia Binata*, J. Nat. Prod., **62**, 1000-1002 (1999).
- (257) A. V. Karginov, M. Lodder and S. M. Hecht, Facile Characterization of Translation Initiation via Nonsense Codon Suppression, Nucleic Acids Res., **27**, 3283-3290 (1999).
- (258) D.-A. Sun, S. R. Starck, E. P. Locke and S. M. Hecht, DNA Polymerase  $\beta$  Inhibitors from *Sandoricum Koetjape*, J. Nat. Prod., **62**, 1110-1113 (1999).

- (259) M. Aso, M. Kondo, H. Suemune and S. M. Hecht, Chemistry of the Bleomycin Induced Alkali-Labile Lesion, *J. Am. Chem. Soc.*, **121**, 9023-9033 (1999).
- (260) J.-Z. Deng, S. R. Starck and S. M. Hecht, DNA Polymerase  $\beta$  Inhibitors from *Baeckea Gunniana*, *J. Nat. Prod.*, **62**, 1624-1626 (1999).
- (261) J. Ma, S. R. Starck and S. M. Hecht, DNA Polymerase  $\beta$  Inhibitors from *Tetracera Boiviniana*, *J. Nat. Prod.*, **62**, 1660-1663 (1999).
- (262) J.-Z. Deng, S. R. Starck and S. M. Hecht, Pentacyclic Triterpenoids from *Freziera sp.* that Inhibit DNA Polymerase  $\beta$ , *BioOrg. Med. Chem.*, **8**, 247-250 (2000).
- (263) S. M. Hecht, Bleomycin: New Perspectives on the Mechanism of Action, *J. Nat. Prod.*, **63**, 158-168 (2000).
- (264) S. R. Starck, J.-Z. Deng and S. M. Hecht, Naturally Occurring Alkylresorcinols that Mediate DNA Damage and Inhibit its Repair, *Biochemistry*, **39**, 2413-2419 (2000).
- (265) B.-N. Zhou, R. K. Johnson, M. R. Mattern, X.-Y. Wang, S. M. Hecht, H. T. Beck, A. Ortiz and D. G. I. Kingston, Isolation and Biochemical Characterization of a New Topoisomerase I Inhibitor from *Ocotea Leucoxylum*, *J. Nat. Prod.*, **63**, 217-221 (2000).
- (266) M. Lodder, C. F. Crasto, A. L. Laikhter, H. An, T. Arslan, V. A. Karginov, G. F. Short, III and S. M. Hecht, Synthesis of Aspartic Acid Derivatives Useful for the Preparation of Misacylated Transfer RNAs, *Can. J. Chem.*, **78**, 884-891 (2000).
- (267) B. Wang, M. Lodder, J. Zhou, T. T. Baird, Jr., K. C. Brown, C. S. Craik and S. M. Hecht, Chemically Mediated Site-Specific Cleavage of Proteins, *J. Am. Chem. Soc.*, **122**, 7402-7403 (2000).
- (268) G. F. Short, III, A. L. Laikhter, M. Lodder, Y. F. Shayo, T. Arslan and S. M. Hecht, Probing the S1/S1' Substrate Binding Pocket Geometry of HIV-1 Protease with Modified Aspartic Acid Analogues, *Biochemistry*, **39**, 8768-8781 (2000).
- (269) J.-Z. Deng, D. J. Newman and S. M. Hecht, Use of COMPARE Analysis to Discover Functional Analogues of Bleomycin, *J. Nat. Prod.*, **63**, 1269-1272 (2000).
- (270) B.-N. Zhou, J. M. Hoch, R. K. Johnson, M. R. Mattern, W.-K. Eng, J. Ma, S. M. Hecht, D. J. Newman and D. G. I. Kingston, Use of COMPARE Analysis to Discover New Natural Product Drugs: Isolation of Camptothecin and 9-Methoxycamptothecin from a New Source, *J. Nat. Prod.*, **63**, 1273-1276 (2000).
- (271) C. J. Leitheiser, M. J. Rishel, X. Wu and S. M. Hecht, Solid Phase Synthesis of Bleomycin Group Antibiotics. Elaboration of Deglycobleomycin A<sub>5</sub>, *Org. Lett.*, **2**, 3397-3399 (2000).
- (272) J.-Z. Deng, S. R. Starck, D. A. Sun, M. Sabat and S. M. Hecht, A New 7,8-Euphadien-type Triterpenoid from *Brackenridgea nitida* and *Bleasdalea bleasdalei* that Inhibits DNA Polymerase  $\beta$ , *J. Nat. Prod.*, **63**, 1356-1360 (2000).
- (273) M. Lodder, B. Wang and S. M. Hecht, N-Substituted 2-Amino-4-pentenoic Acids for Amino Acid Protection and Resolution, *Tetrahedron*, **56**, 9421-9429 (2000).

- (274) T. T. Baird, Jr., B. Wang, M. Lodder, S. M. Hecht and C. S. Craik, Generation of Active Trypsin by Chemical Cleavage, Tetrahedron, **56**, 9477-9485 (2000).
- (275) S. M. Hecht, Camptothecin as Probes of the Microenvironments of Topoisomerase I-DNA Complexes, in "The Camptothecins", J. G. Liehr, B. C. Giovanella, C. F. Verschraegen, Eds., New York Academy of Sciences, 2000, pp 76-91.
- (276) N. E. Fahmi, S. Golovine, B. Wang and S. M. Hecht, Studies Toward the Site Specific Incorporation of Sugars into Proteins: Synthesis of Glycosylated Aminoacyl-tRNAs, Carbohydr. Res., **330**, 149-164 (2001).
- (277) A. K. Choudhury, Z.-F. Tao and S. M. Hecht, Synthesis and DNA Cleavage Activity of a Novel Bleomycin A<sub>2</sub> Glycoconjugate, Org. Lett., **3**, 1291-1294 (2001).
- (278) A. T. Abraham, X. Zhou and S. M. Hecht, Metallobleomycin-Mediated Cleavage of DNA Not Involving a Threading Intercalation Mechanism, J. Am. Chem. Soc., **123**, 5167-5175 (2001).
- (279) S. Hashimoto, B. Wang and S. M. Hecht, Kinetics of DNA Cleavage by Fe(II)•Bleomycins, J. Am. Chem. Soc., **123**, 7437-7438 (2001).
- (280) Krogh, B. O., Claeboe, C. D., Hecht, S. M. and Shuman, S., Effect of 2'-5' Phosphodiesterases on DNA Transesterification by Vaccinia Topoisomerase, J. Biol. Chem., **276**, 20907-20912 (2001).
- (281) M. L. Sznaidman and S. M. Hecht, Studies on the Total Synthesis of Tallysomycin. Synthesis of the Threonylbithiazole Moiety Containing a Structurally Unique Glycosylcarbinolamide, Org. Lett., **3**, 2811-2814 (2001).
- (282) M. J. Rishel and S. M. Hecht, Analogues of Bleomycin: Synthesis of Conformationally Rigid Methylvalerates, Org. Lett., **3**, 2867-2869 (2001).
- (283) J. C. Quada, Jr., D. Boturyn and S. M. Hecht, Photoactivated DNA Cleavage by Compounds Structurally Related to the Bithiazole Moiety of Bleomycin, Bioorg. Med. Chem., **9**, 2303-2314 (2001).
- (284) M. V. Keck, R. A. Manderville and S. M. Hecht, Chemical and Structural Characterization of the Interaction of Bleomycin A<sub>2</sub> with d(CGCGAATTCGCG)<sub>2</sub>. A Double-Strand Cleavage Accessible Without Structural Reorganization, J. Am. Chem. Soc., **123**, 8690-8700 (2001).
- (285) C. J. Thomas, M. M. McCormick, C. Vialas, Z.-F. Tao, C. J. Leitheiser, M. J. Rishel, X. Wu and S. M. Hecht, Alteration of the Selectivity of DNA Cleavage by a Deglycobleomycin Analogue Containing a Trithiazole Moiety, J. Am. Chem. Soc., **124**, 3875-3884 (2002).
- (286) B. Wang, K. C. Brown, M. Lodder, C. S. Craik and S. M. Hecht, Chemically Mediated Site-Specific Proteolysis. Alteration of Protein-Protein Interaction, Biochemistry, **41**, 2805-2813 (2002).
- (287) K. L. Smith, Z.-F. Tao, S. Hashimoto, C. J. Leitheiser, X. Wu and S. M. Hecht, Solid Phase Synthesis and DNA Cleavage by Deglycobleomycin, Org. Lett., **4**, 1079-1082 (2002).



- (288) P. B. Arimondo, A. Boutorine, B. Baldeyrou, C. Bailly, M. Kuwahara, S. M. Hecht, J.-S. Sun, T. Garestier and C. Hélène, Design and Optimization of Conjugates of Camptothecin Derivatives of Triple Helix-Forming Oligonucleotides for Sequence-Specific DNA Cleavage by Topoisomerase I, J. Biol. Chem., **277**, 3132-3140 (2002).
- (289) Z.-F. Tao, C. J. Leitheiser, K. L. Smith, S. Hashimoto and S. M. Hecht, Solid Phase Synthesis of Deglycobleomycins: A C-Terminal Tetraamine Linker that Permits Direct Evaluation of Resin-Bound Bleomycins, Bioconjugate Chem., **13**, 426-434 (2002).
- (290) Y. Zou, N. E. Fahmi, C. Vialas, G. M. Miller and S. M. Hecht, Total Synthesis of Deamido Bleomycin A<sub>2</sub>, the Major Catabolite of the Antitumor Agent Bleomycin, J. Am. Chem. Soc., **124**, 9476-9488 (2002).
- (291) R. D. Anderson, J. Zhou and S. M. Hecht, Fluorescence Resonance Energy Transfer Between Unnatural Amino Acids in a Structurally Modified Dihydrofolate Reductase, J. Am. Chem. Soc., **124**, 9674-9675 (2002).
- (292) B. M. Eisenhauer and S. M. Hecht, Site-Specific Incorporation of (Aminoxy)acetic Acid into Dihydrofolate Reductase, Biochemistry, **41**, 11472-11478 (2002).
- (293) C. J. Thomas, A. O., Chizhov, C. J. Leitheiser, M. J. Rishel, K. Konishi, Z.-F. Tao and S. M. Hecht, Solid Phase Synthesis of Bleomycin A<sub>5</sub> and Three Monosaccharide Analogues. Exploring the Role of the Carbohydrate Moiety in RNA Cleavage, J. Am. Chem. Soc., **124**, 12926-12927 (2002).
- (294) J.-Z. Deng, R. Marshall, S. H. Jones, R. K. Johnson and S. M. Hecht, DNA Damaging Agents from *Crypteronia Paniculata*, J. Nat. Prod., **65**, 1930-1932 (2002).
- (295) S. M. Hecht, RNA Targeting by Bleomycin, in "DNA and RNA Binders: From Small Molecules to Drugs," M. Demeunynck, C. Bailly and W. D. Wilson, Eds., Vol. 1, Wiley-VCH, 2003, pp 41-57.
- (296) D. C. Taylor, R. R. Poelling, S. V. Mamaev, S. M. Hecht and F. J. Schmidt, *In Vitro* Riboregulation by Combinatorially Selected RNA, Chemistry & Biology, in press.
- (297) S. M. Hecht, Inhibitors of Topoisomerase I Function, in "Camptothecins in Cancer Chemotherapy", T. G. Burke, Ed., Humana Press, in press.
- (298) Y.-M. Xu, J.-Z. Deng, J. Ma, S.-N. Chen, R. Marshall, S. H. Jones and S. M. Hecht, DNA Damaging Activity of Ellagic Acid Derivatives, BioOrg. Med. Chem., in press.
- (299) A. T. Abraham, D. L. Newton, J.-J. Lin, S. Rybak and S. M. Hecht, RNA Cleavage and Inhibition of Protein Synthesis by Bleomycin, Chemistry & Biology, in press.
- (300) H. An, K. Katano, A. A. Padmapriya, C. D. Hess and S. M. Hecht, Total Synthesis of Bleomycin Group Antibiotics. Total Syntheses of Decarbamoyl Bleomycin Demethyl A<sub>2</sub>, Decarbamoyl Bleomycin A<sub>2</sub> and *epi*-Decarbamoyl Bleomycin Demethyl A<sub>2</sub>, J. Am. Chem. Soc., submitted.
- (301) J. Ma and S. M. Hecht, Javaniside, A Novel DNA Cleavage Agent from *Alangium Javanicum* Having an Unusual Oxindole Skeleton, J. Chem. Soc., Chem. Commun., submitted.

- (302) M. M. McCormick and S. M. Hecht, Synthesis of Methyl 2-Chloroacetyl-1-methylimidazole-4-carboxylate, a Useful Intermediate for Preparing Bleomycin Libraries, Synlett., submitted.
- (303) W. C. Stevens, Jr., X.-Y. Wang and S. M. Hecht, On the Relationship Between the Efficiencies of DNA Unwinding and Cleavage by Bleomycin Derivatives, Biochemistry, submitted.
- (304) J. Ma, X. Wu, S. Jones, R. Marshall and S. M. Hecht, DNA Topoisomerase I Inhibitors from *Rinorea Anguifera*, Org. Lett., submitted.
- (305) N. E. Fahmi, L. Dedkova, B. Wang, S. Golovine and S. M. Hecht, Site Specific Incorporation of Glycosylated Serine and Tyrosine Derivatives into Proteins, J. Am. Chem. Soc., submitted.
- (306) A. K. Choudhury, S. Y. Golovine, L. Dedkova, A. L. Laikhter and S. M. Hecht, Analogues of Firefly Luciferase Containing Modified Arginine Residues, J. Am. Chem. Soc., submitted.
- (307) A. Cagir, Z.-F. Tao, C. J. Leitheiser, S. J. Sucheck and S. M. Hecht, Solid Phase Synthesis and Biochemical Evaluation of Conformationally Constrained Analogues of Deglycobleomycin A<sub>5</sub>, BioOrg. Med. Chem., submitted.
- (308) B. Wang, J. Zhou, M. Lodder and S. M. Hecht, Tandemly Activated Transfer RNAs Participate in Protein Synthesis, Science, submitted.
- (309) M. J. Rishel, C. J. Thomas, Z.-F. Tao, C. Vialas, C. J. Leitheiser and S. M. Hecht, Conformationally Constrained Analogues of Bleomycin A<sub>5</sub>, J. Am. Chem. Soc., submitted.
- (310) C. J. Leitheiser, K. L. Smith, M. J. Rishel, S. Hashimoto, K. Konishi, C. J. Thomas, C. Li, M. M. McCormick and S. M. Hecht, Solid Phase Synthesis of Bleomycin Group Antibiotics. Construction of a 108-Member Deglycobleomycin Library, J. Am. Chem. Soc., submitted.
- (311) R. D. Anderson, III, N. E. Fahmi, J. Zhou and S. M. Hecht, Introducing New Protein Functions through Multiple Nonsense Codon Suppression, Science, submitted.
- (312) L. M. Dedkova, N. E. Fahmi, S. Y. Golovine and S. M. Hecht, Efficient D-Amino Acid Incorporation into Protein by Modified Ribosomes, Science, submitted.
- (313) J. A. Smith, Y. Xu, S. M. Hecht and D. Lannigan, A p90 Rsk-Specific Inhibitor, SL0101, Inhibits Transformed Cell Proliferation, Nature, submitted.

### **Books Edited**

- (1) Bleomycin: Chemical, Biochemical, and Biological Aspects, S.M. Hecht, Ed., Springer Verlag, New York, 1979
- (2) Bioorganic Chemistry: Nucleic Acids, S.M. Hecht, Ed., Oxford University Press, New York, 1996.
- (3) Bioorganic Chemistry: Peptides and Proteins, S. M. Hecht, Ed., Oxford University Press, New York, 1998.
- (4) Bioorganic Chemistry: Carbohydrates, S. M. Hecht, Ed., Oxford University Press, New York, 1999.

### Other Publications from Hecht Laboratory

- (1) J. R. Barr, R. T. Scannell and K. Yamaguchi, Structure Elucidation of Naturally Occurring Long-Chain Mono- and Dienes, J. Org. Chem., **54**, 494-496 (1989).
- (2) D. B. Killian and S. M. Hecht, Redox Glycosidation: A New Strategy for Disaccharide Synthesis, Condensation and Commentary, Chemtracts - Org. Chem., **2**, 374-376 (1989).
- (3) B. J. Carter and S. M. Hecht, Evidence for Spontaneous, Low-Temperature Biradical Formation From a Highly Reactive Neocarzinostatin Chromophore-Thiol Conjugate, Condensation and Commentary, Chemtracts - Org. Chem., **3**, 226-228 (1990).
- (4) S. M. Hecht, Double-Strand Cleavage of Genomic DNA at a Single Site by Triple-Helix Formation, Condensation and Commentary, Chemtracts - Org. Chem., **3**, 218-221 (1990).
- (5) R. J. Duff and S. M. Hecht, Synthesis of Covalently Linked Double-Helical Cross Sections Representative of Purine-Pyrimidine, Purine-Purine and Pyrimidine-Pyrimidine Duplexes, Condensation and Commentary, Chemtracts-Org. Chem., **5**, 133-136 (1992).

## Sidney M. Hecht

### Patents and Patent Applications

1. Sidney M. Hecht and John W. Kozarich, Alkylations Employing In Situ Generation of Diazoalkane Alkylation Reagents, U.S. Patent 3,963,698, June 15, 1976.
2. Folke Skoog, Ruth Y. Schmitz, Sidney M. Hecht and Robert Bruce Frye, 4-Substituted Amino-2-substituted Thio-pyrazolo[2,3-D]pyrimidine Derivatives, U.S. Patent 3,988,338, October 26, 1976.
3. Sidney M. Hecht and Ulrich Jordis, Synthesis for 7-Alkylamino-3-methylpyrazolo[4,3-d]pyrimidines, U.S. Patent 4,282,361, August 4, 1981.
4. Sidney M. Hecht, Biologically Active Extracts from *Myristica castaneifolia* (Myristicaceae) Fiji and a Method of Obtaining Same, U.S. Patent 4,352,797, October 5, 1982.
5. Sidney M. Hecht, Biologically Active Extracts from *Cerastium viscum* L. (Coryophyllaceae) Mississippi and Method of Obtaining Same, U.S. Patent, 4,454,124, June 12, 1984.
6. Sidney M. Hecht, David G. Lynn and Kalakota S. Reddy, Lipoglycosides and Process of Extracting Same, U.S. Patent 4,590,264, May 20, 1986.
7. Jeffrey C. Boehm, Sidney M. Hecht, Kenneth G. Holden, Randall K. Johnson and William D. Kingsbury, Water Soluble Camptothecin Analogs, U.S. Patent 5,004,758, April 2, 1991.
8. Sidney M. Hecht, Oligonucleotide N-Alkylphosphoramidates as Polynucleotide Binding Agents, U.S. Patent 5,519,126, May 21, 1996.
9. Sidney M. Hecht, Method for the Cell-Free Synthesis of Proteins, U.S. Patent 5,571,690, November 5, 1996.
10. Edward P. Locke and Sidney M. Hecht, Inhibition of Carbohydrates Metabolism by Quinone Compounds, U.S. Patent 6,075,057, June 13, 2000.
11. Sidney M. Hecht and Michiel Lodder, 4-Pentenoyl Groups for Derivatization and Protection of Amino Acids, U.S. Patent 6,245,938, June 12, 2001.
12. Sidney M. Hecht, Vladimir Karginov and Andrei V. Karginov, In Vitro Suppression as a Tool for the Investigation of Translation Initiation, U.S. Patent Application filed May 13, 1998.